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THE SCOPE AND PRESENT POSITION OF BIO-CHEMISTRY.

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The practical value of pure science is now so generally recognized that no excuse need be given for a plea on behalf of a neglected department. Especially is this true of a department which so closely concerns our bodily welfare as does physiological, or bio-, chemistry. This science has not received in America that recognition and support which its importance as an applied or pure science would warrant. This may be due, in part, at least, to a failure to realize that to biochemistry belong problems outside the scope of any other science; it may, therefore, not be out of place to indicate briefly what some of these problems are, and to what position, in the world at large, this new science has now attained.

Although it is impossible to define sharply the limits of a science it may be said, in a general way, that to biochemistry belong all problems of the chemistry of living matter, or of the chemistry of metabolism. It is thus the complement of the group of sciences treating of the forms and relationships of organisms, botany and zoology, and of the mechanics of organisms, or physiology proper. Touching each of these sciences closely, it receives from each special problems for solution.

Among the more important problems of plant biochemistry are the chemical nature of chlorophyll, the nature and manner of action of the starch-forming substance, the determination of the substances out of which the plant synthesizes its protoplasm, and the nature of this synthesis. In bacteriology the biochemist has a wide field for work. The isolation of the specific immunizing substance in the antitoxins of diphtheria, tetanus and other cases of artificial immunity, is a matter of great practical importance. There is pressing need of a chemical examination of the bacteria and their products, whether poisonous or not. The determination of the active substance in such bodies as the tubercle bacilli, which cause cell proliferation, is an interesting matter which might have a considerable practical value.

In physiology, biochemistry has hitherto played its chief rôle in the study of excretion and digestion. The results obtained have thrown light on the functions of many organs. An interesting question of physiology at the present time is that of the internal secretions of glands. It is becoming increasingly probable that these form an important element in the coördination of the organism, one organ or gland forming and throwing back into the blood substances essential to the life of some other organ. The determination of these substances, of such preeminent importance to the organism, is a biochemical problem. The isolation of the contractile substance in muscle, the chemical changes undergone by muscle and nerve during activity, the nature of the irritable substance of the nervous system, are puzzles which fall to the biochemist. Our knowledge of the chemical constitution of the fluids and tissues of the body in health and disease is derived from this science.

In the province of biology the ultimate aim, however distant the goal may be, is the analysis and synthesis of living matter itself. The explanation of the formation of new protoplasm will probably come from the biochemist. He must isolate and examine the various substances in the cell. That this field is full of promise is evident from the results already obtained. Morphology, too, furnishes its quota of problems. The influence of certain substances upon embryonic development is in part

chemical. We are now familiar with the progressive differentiation of organs from the egg, but of the nature of the chemical differentiation which this structural differentiation implies little is as yet known. Whether the chromatins of the cells derived from the egg are different from that of the egg-cell, and in what way, is a question of theoretical interest to be answered definitely only by biochemical research. The determination of the chemical nature of the substance causing cell division, karyokinesis, of the substances formed, and of the nature of the changes undergone, is essential to the understanding of this process. The answer to these questions may be of value in the explanation of tumors and other pathological growths involving karyokinesis.

Biochemistry has perhaps its chief practical worth in medicine. The physician it serves not only indirectly through the solution of physiological and bacteriological problems, but directly in testing the action of drugs and diets upon metabolism, and in the careful study of the urine and blood in health and disease. The physician is thus given an accurate means of diagnosis in certain diseases. An interesting result accomplished recently in this direction has been the discovery of the origin of uric acid, a substance of considerable pathological interest, in the chromatin of the cell-nuclei, and thereby a possible explanation is given of the action of quinine, antipyrin, and antifebrin, in decreasing the secretion of this substance.

Another practical biochemical problem important in medicine is the isolation from glands and other organs of their so-called "internal" secretions already mentioned. Hitherto, in treating myxœdema, goitre, or Addison's disease, by the so-called extract therapie, physicians have used either the whole substance of the thyroid, or thymus glands and the suprarenal capsules, or extracts of these organs—a process which introduces useless as well as healing matter. It would be advantageous to use the pure remedial substance alone. In one of these organs this is now possible, two biochemists having recently isolated the healing substance from the thyroid gland so that it is now prepared pure for the physician. It is not too much to hope that similar substances will be isolated from other

glands and organs, and that the physician of the future will be able partly to maintain the metabolic equilibrium of the body, or to restore that equilibrium when disturbed, by supplying the missing substances.

The composition of the yeast-cell, its metabolism when fed on different substances and under different conditions, the determination of the sugars which it will, or will not ferment, and the isolation of its special ferments, are problems important for the brewer, the winemaker and the baker.

The questions thus brifly indicated form a well-defined group. They constitute the problems of one science. Many of these problems cannot be satisfactorily dealt with either by the organic chemist alone or the physiologist alone. The biochemist needs both a theoretical and practical knowledge of animal and plant morphology and physiology, which is largely superfluous in the analysis and synthesis of the great majority of organic substances. On the other hand these problems cannot be left to the physiologist, for few physiologists have the time or opportunity to acquire the necessary chemical knowledge. Even pure physiology alone is so broad that one is rarely found thoroughly familiar with more than a portion of it.

It is for these reasons desirable that the independent position of biochemistry should be recognized, and equipment and means provided for its development. And it is an encouraging sign of the times that so eminent an organic chemist as Emil Fisher, has recently spoken strongly for the independent position of biochemistry.

In Europe, largely owing to the winning personality and untiring labors of the late Felix Hoppe-Seyler, the science is now beginning to receive recognition. The modern science of biochemistry, indeed, may be said to have been founded by this illustrious man; for, although previous to him work had been done in a biochemical direction by chemists, physiologists, agriculturists, and others, he was the first to urge the independent position of this science. An Institute and Professorship of Physiological Chemistry were established for him at Strassburg. He founded a journal in which papers treating of bio-

chemical matter could appear, and thus brought to a focus a number of lines of effort which had formerly been scattered in chemical, physiological and agricultural publications. The founding of the Strassburg Institute and Professorship was the official birth of biochemistry.

But, although great progress has been made since Hoppe-Seyler opened his first laboratory in the kitchen of the old castle in Tübingen, the position of the biochemist in Germany is still behind that in many other European countries. The Strassburg Institute remains the only purely biochemical institute in Germany. In many German universities the biochemists are nominally full professors of physiology, as in Heidelberg (Kühne), Marburg (Kossel), and Munich (Voit); in others, besides the full professor (ordinarius) of physiology there is an associate professorship (extraordinarius) in physiological chemistry. This is the case in Berlin (Thierfelder) and Breslau (Röhmann). In still others the professors of pharmacology take over the duties of the biochemist, as in Rostock (Nasse), Königsberg (Jaffé), Giessen (Gähtgens) and Halle. In Tübingen the physiological chemist is called professor of applied (angewandte) chemistry, and belongs to the philosophical faculty; in Freiburg he is professor of chemistry and belongs to the medical faculty; in Leipsic he is a privat docent (instructor) in the physiological institute. In the universities of Göttingen, Kiel and Würzburg there is no special instruction in this science. In Germany, therefore, although the science is recognized in nearly all universities, and its teachers in many cases full professors, they are generally handicapped by being required to teach chemistry, physiology, or pharmacology.

Outside of Germany the situation is generally more favorable. In Austria the universities (Prague, Vienna and Gratz) have professorships in medical chemistry. In Switzerland there are professorships of physiological chemistry in Basel (Bunge) and Berne (Drechsel). At Zürich there is none, though a good deal of work is done in the agricultural chemical laboratories. In Norway, at Christiania, there is no chair of physiological chemistry. In Russia nearly all the universities—Moscow, St. Petersburg, Warsaw, Kieff, etc.—have chairs of

physiological chemistry. In Galicia such professorships are established in the universities of Lemberg and Krakow. In Italy and France, as far as I can learn, there are no such professorships, but accurate information is lacking. In Sweden, at Upsala, the biochemist Hammarsten is Professor of Physiological and Medical Chemistry. At Stockholm there is also a professorship in this science, as well as in Lund. It all these cases, it will be understood, there are separate professorships in physiology. In England there are no professorships of biochemistry. The biochemist Halliburton is Professor of Physiology in Kings College, London. In Cambridge University, in the extensive laboratories of Professor Michael Foster, considerable space is devoted to biochemistry under the direction of Dr. Sheridan Lea.

In Germany there is one magazine, "Die Zeitschrift für Physiologioche Chemie," devoted entirely to this science. About four-fifths of the "Zeitschrift für Biologie," one-fourth of Pflüger's "Archiv für die gesammte Physiologie," nearly all of Schmiedeberg's "Archiv für experimental Pathologie u. Pharmakologie" consist of biochemical papers. Many papers also appear in Virchow's Archiv, in the Bacteriologische Centralblatt and various other scientific publications.

In England the "Journal of Physiology" contains a greater or less number of biochemical articles—but there is not in the English language any magazine devoted exclusively to this science. Nor is there any American Journal of Physiology in which biochemical papers could appear. The English Journal of Physiology is the only journal which will give physiological and biochemical papers a general circulation. It is unfortunate that so large a proportion of physiological papers from American laboratories should be driven to the German journals and language. This is the more to be regretted since the history of the Journal of Morphology teaches that an American physiological journal, publishing papers of a high class, would have an assured circulation among European scientific men.

We, in America, are in a backward condition when compared with Germany, Russia, Sweden and Switzerland. Biochemistry in America has suffered, like physiology, from being con-

fined to the medical schools. Here both have been treated too largely as applied sciences. Both would greatly profit in being taken from the medical schools and established, like physics or chemistry, in separate institutes where both the pure and applied science should be taught. The biochemical laboratory should be one of the laboratories of the university, just as the laboratory of experimental physiology, or organic chemistry. It should be in the hands of investigators, and should give instruction not only in urine analysis, but in the principles of metabolism. For the purpose of mutual helpfulness it should be in close connection with the laboratories of experimental physiology and organic chemistry. It is greatly to be hoped that the progress of this science in America may be furthered by the establishment of professorships of biochemistry and of an American Journal of Physiology and Biochemistry to provide a ready means of publication for physiological and biochemical papers.

THE POLYPHYLETIC DISPOSITION OF LICHENS.[1]

By Frederic E. Clements.

The present trend of thought upon the morphology and disposition of the lichens must be most encouraging to those, who stood at first alone, and then with ever-increasing company, for the complete acceptation of the Schwendenerian hypothesis, and of the morphologic and phylogenetic theories involved in it. Even during the present decade, botanical literature has not lacked for articles, penned chiefly by lichenologists, disproving in its entirety the algo-lichen theory, and maintaining the autonomy of the lichens, as they are pleased to term it. When the "symbiosis", "consortism," or parasitism of lichens was established beyond a doubt, and polyphylesis was postulated as a necessary consequence, the lichenographers again rose en masse, arguing and pleading for the dignity and autonomy of their group. Since the tacit and universal

[1] Read before the Botanical Seminar of the University of Nebraska. December 5, 1896.

acceptance of the polyphyletic origin of the lichens, opposition to their distribution among the other fungi had practically ceased, until the revival of the question by Reinke's articles published during the past year or two.

To the Seminar, which has stood since its inception unqualifiedly for the Schwendenerian theory, and for the consideration and treatment of all fungi as fungi, my task will seem a gratuitous one. It may not be, however, entirely unprofitable to consider in detail the arguments still advanced by some botanists against what is here regarded as the ultimate disposition of the lichens.

In addition to Reinke's rather exhaustive papers, Gregory and Schneider have written short articles, chiefly recapitulatory of Reinke's views, and hence of little import, were it not for the fact that the first endeavors to throw the weight of Schwendener's half-expressed disapproval to her side of the question. Reinke's articles, however, form the rallying ground of all those fearful of the degradation of the autonomous dignity of the lichens, and will alone be discussed here. His conclusions are based upon serious work, and, in consequence, deserve earnest consideration, although not infrequently ridiculous to one free from the trammels of "consortism," "mutualism," etc.

The greater portion of Reinke's arguments are given in his second paper (Pringh. Jahrb. 26 : 524, 1894). In the prefatory remarks to his fifth article (Pringh. Jahrb. 29 : 171, 1896), which treats of the natural lichen-system, he adduces certain general arguments that have equal weight on either side, and makes some specific objections that have little relevancy and less significance. In consequence, the following discussion will be limited chiefly to the second paper, the more important points of which will receive successive treatment.

"Concerning ascolichens, it may be postulated that the component fungus no more exists, probably never existed, in the free state." Since lichens are lichens, and, according to Reinke, every lichen a "consortium," whether its fructification be by means of asci or by basidia, he begs the question in limiting his statement to ascolichens. In complete refutation

of this, I might then cite Moeller (Flora 77 : 253, 1893), who shows conclusively that the thelephoroid fungus represented by the three lichen genera, *Cora, Dictyonema*, and *Laudatea*, may be, at the same time, a saprophyte, or a parasite upon two different genera of algæ, *i. e.*, a facultative parasite. For the ascolichens, Reinke contradicts his own statement that their fungal prototypes no longer exist (Pringh. Jahrb. 28 : 71, 87, 135, 1895). The mere fact that he has been obliged to divide the genera *Calicium, Bilimbia, Bacidia, Placographa, Melaspila* and *Arthonia* into a series of lichen genera corresponding respectively to the above, and a series of "myco-genera," *Mycocalicium, Mycobilimbia, Mycobacidia*, etc., solely because certain fungi, having parasitized accidental algal cells, have lost their saprophytic habit, is conclusive. It is also admitted by the best mycologists that *Biatoridium, Lecidea* and *Buellia* can be distinguished from *Biatorella, Patinella*, and *Karschia* only through what can be called scarcely more than incipient parasitism. More than this, *Buellia myriocarpa*, as Reinke himself admits (Pringh. Jahrb. 28 : 93, 1895), is sometimes provided with gonidia, sometimes lacks them. It is then either a fungus or a lichen. This species is certainly a remarkable one, in that it belongs to two different and distinct subkingdoms, or at least classes! Were cumulative evidence needed, the repeated artificial synthesis and analysis of lichens would be more than sufficient to discredit Reinke's statement, notwithstanding his inability to appreciate the weight of these facts.

It is a scientific truism that phylogeny is the science of probabilities. No thoughtful scientist should dream of demanding absolute proof in general phylogenetic problems. In discussing questions of phylogeny, when the ultimity of probability is reached, except in the rarest cases, argumentation must cease. As for hymenolichens, we may regard Moeller's careful researches as, comparatively speaking, absolute proof of their direct and recent derivation from the *Thelephoraceæ*. For the ascolichens, enough has been said to demonstrate the conclusion toward which extreme probability points.

"The attempts at the distribution of the lichens have been of an unsatisfactory nature." It is by no means true that, to

know the need of a reform, one must know how to bring such a reform about. If the method of reformation, or of rearrangement is hard to discover in those matters in which the factors are well-known and can be carefully weighed, how much more difficult is it where phylogeny with its undiscovered and undiscoverable quantities complicates. May we not, then, be pardoned if we consider Reinke's criticism of Von Tavel's endeavor to distribute the lichens as essentially puerile, and of negative weight in serious discussion?

"Taxonomy should, moreover, follow practical lines." It has been generally supposed that the constant endeavor of taxonomy during the past century has been to rid itself of the burden of practicality. If, as Reinke suggests, attempts to discover the phylogeny of any plant-group must always be unfruitful to a great extent, then a practical system, not a theoretical one, is a desideratum. If this is true, it is both remarkable and unfortunate that the best botanical effort of decades past has been directed to the replacement of artificial systems by natural ones, and to the improvement of the latter. As a matter of fact, such is not true. Taxonomy is, ultimately, never a means, but an end, and the demands of practicality in a system are entirely without force, until those are fully met which are entailed by the departments of botany that true taxonomy should summarize. Thus, the rapidity with which a system may be leaved over, is no index of its value. In fact, natural systems are necessarily complicated, and great convenience and "usability" in any system are in themselves suspicious. Reinke laments the fact that the lichens have disappeared so suddenly from a prominent place in texts, that it often involves trouble to find them in "anhänge" to different fungus-groups. Likewise, it would require less manual labor if the lower cryptogams were still grouped as algæ and fungi, and, from the same point of view, it is a great bother to follow an apetalous family into some obscure nook among the *Choripetalæ.* Yet there are those who prefer an expression of probable phylogenetic relationship in a system to mere utility, and, who, unlike Reinke, have no "misgivings as to the fitness of arranging a great plant-group, so rich in forms and numbers

as the lichens," in "anhänge," until a better disposition is possible.

The lichenologists, the specialists in this branch, "have intuitively opposed the "sidetracking" of the lichens." I mention this argument of Reinke's merely to show the peculiar cogency so characteristic of his article. It would not have been inopportune to cite the particularly felicitous, intuitive opposition of lichen-specialists to the Schwendenerian theory. But the author, naively, states that, while he has sympathised with this later stand of lichenologists, it was unfortunate that their weapons were directed against the Schwendenerian theory.

"In the form and structure of their vegetative organs, the lichens are closely connected with the other green, chlorophyll-bearing plants." If it were worth while to discuss this question, it might be readily shown that the only resemblance in form is a superficial one, due to parallelism, while the other great similarity arises from the fact that the one possesses assimilative power in and of itself, while the other appropriates that inherent in another organism. It is useless to press this point, however, since it is directly dependent upon whether the lichen is regarded as a instance of parasitism, or of "consortism."

Reinke, apparently, labors constantly under the delusion that those who contend for the distribution of the lichens, deny their polyphylesis. Contrariwise, they were the first to postulate and to establish it. All are in accord that, while the lichens originated from the fungi polyphyletically, this origination occurred at comparatively few points, and that the modification and specialization of these phylogenetic lines took place after the fungus had become parasitic upon an alga. No one who traces the lichens back to the fungi would for an instant maintain that each lichen family finds its prototype among the fungi. But, on the other hand, one must insist that at those points where fungi passed into lichens, an almost perfect series of gradations is noted, and that phylogenetic and morphologic continuity are complete at these places.

Naturally, the chief argument of the author is that the lichen is not a parasite, but a "consortium." In direct con-

tradiction to this, as Reinke himself admits, is De Bary's statement that the fungus occasions considerable change in the host, the alga. Reinke is unable to evade this, but prefers to interpret it as an advantageous adaptation due to the synthesis of fungus and alga to form a "consortium." Then, in like manner, the increased rapidity of division, and the great distension of the cells of an elder leaf, occasioned by the presence of æcidial filaments, are adaptations traceable to incipient "consortism," if you wish, parasitism, in reality. The mere fact that the histogenetic relations of the cells in a tissue are not such that continuous multiplication of cell-individuals is possible, as is the case with free algæ, has no significance. The tissue-cell and the free alga exhibit essentially the same biological behavior when parasitized. The only difference is that, in the one case, cytogenesis fixes a limit, in the other, it does not.

In many cases, moreover, parasitism effects little or no change in the tissues. This is notably the case in Erysipheæ, in many Peronosporaceæ, and Uredineæ. On the other hand, algal cells often become so completely involved in hyphal threads that division is impossible, when the existence of real parasitism is quickly demonstrated.

The significance of the soridium and of hymenial gonidia is regarded by Reinke as very considerable. To me, both, but the soridium especially, are mere modifications of the fungus due to changed habit, and contingent upon incipient or advanced desexualisation. The significance of either, were they universally present, would be neither profound, nor otherwise inexplicable. The fact that they occur almost wholly among forms possessing a thallus of a considerable degree of development, and the fact of their utter absence in the primitive types is sufficient proof of their lack of meaning. Of equal weight is the presence of lichenin. The elementary condition of our knowledge of microchemistry should deter anyone from generalizations derived therefrom. Reinke's statement concerning the characteristic presence of many chemical substances is essentially one of the antiquated arguments of the lichenologists, and is scarcely more valid than that one in which, speak-

ing of the discriminative powers of certain genera of insects, which feed upon lichens, and not upon fungi, Cooke says: "These insects must have come to a sounder conclusion than some men, viz., that lichens are not fungi with the addition of an innocuous green alga."

The most curious error of Reinke's is made in explanation of Moeller's researches upon *Hymenolichenes.* The author says frankly that after reading Moeller's article he asked himself if its conclusions were contrary to his opinions. At the same time, he affords an instructive illustration of how the interpretation of a fact may entirely controvert its meaning. If one were to find a facultative parasite growing at the same time on the ground, and upon two different host-plants, the explanation would be so obvious that one would not waste a thought upon it. The fact that the saprophyte exists alongside the parasite, the lichen, would mean simply that here was the starting-point of a phylum. Not so with Reinke. To him the occurrence of *Cora* as a facultative parasite signifies that here is a fungus, which forms "consortiums" with different algæ, a proof. as he takes it, that the fungus alone is insufficient for the thallus-body. Also, a proof in my mind that a host is indispensible to any parasite. As for the occurrence of hymenomycete and hymenolichen together, Reinke considers this entirely analogous to the concomitant appearance of alga and lichen, and, as I have pointed out above, this is true, since it involves nothing more than the simultaneous occurrence of a saprophyte, its host, and the same saprophyte in the role of a parasite.

I have taken up the above arguments in detail merely to demonstrate the little bearing they have upon the question. In determining relationships, phylogeny alone has value; histogeny, morphology, and physiology are useful only so far as they can furnish data respecting the probable phylogeny. I have already said enough to show that I appreciate the exceeding difficulty of retracing phylogenetic results. Happily, in the lichens, the phyletic lines are comparatively short; this is especially true in the hymenolichens, where the developmental processes are going on before our eyes. On the one side is the

indubitable fungus ancestor, the thelephora; on the other, the two direct descendants, *Cora,* and *Dictyonema,* incipient phyla, whose future directions of development are foreshadowed in the *Laudatea*-forms.

The ascolichens were derived from the *Ascomycetes* at an earlier period, and their great specialization and the interval of time elapsed have to a considerable degree obscured the points of departure. But, as has been pointed out above, the "fungo-lichen" genera, *Calicium, Bilimbia, Bacidia, Placographa, Melaspila, Biatorella-Biatoridium, Patinella-Lecidea, Buellia-Karschia, Graphis-Hysterium,* and the species, *Buellia myriocarpa,* leave little doubt concerning the derivation of their corresponding families. They simply await the thorough investigation given hymenolichens by Moeller. If we are to consider only the highly specialized ends of phylogenetic branches, we should all be constrained to admit that lichens must receive treatment as a group. But, in such an event, we should do the greatest violence to phylogenesis as the determinant in taxonomy, in making lichens coördinate with algæ and fungi, merely on the basis of a physiological character. I admit that there could be a class, or a branch, *Lichenes,* based upon this physiological character, or perhaps upon morphological characters induced by adaptation to assimilation-processes. So, also, might there be a group, *Parasiticæ,* coördinate with *Phanerogamæ,* which would include such closely related genera as *Cuscuta, Razoumofskya, Phoradendron, Thalesia,* etc. Such is the logical result of Reinke's opinion that a more or less constant physiological character, for lichens, "consortism," obtains for the delimitation of great groups, in spite of the significant evidence of phylogeny.

Summarizing: Reinke's conclusion that lichens are physiologically and morphologically distinct from fungi is untrue, and his statement that it is impossible, on account of certain physiological characters, to distribute them among fungi is equally unwarranted.

FOSSILS AND FOSSILIZATION.

By L. P. Gratacap.

(*Continued from page 199.*)

There are many facts in chemistry which show that there can be mutual displacements in solutions of various substances, although there is also a series of facts that prove the additional solubility of insoluble salts in the presence of other salts or in dilute solutions. Thus, when certain salts, dissolved in a small quantity of water decompose one another by double interchange of bases and acids, producing a precipitate of a difficultly soluble salt, no precipitate occurs in more dilute solutions, although the quantity of water present would not be sufficient to hold in solution the less soluble salt, which may be produced by the decomposition, if it existed in the separate state. For example, sulphate of lime requires about 400 parts of water to dissolve it; but chloride of calcium, dissolved in about 200 parts of water, gives no precipitate with sulphate of potash. It is supposed that the formation of sulphate of lime takes place, but that the presence of the chloride of potassium, which is formed at the same time, renders it more soluble than it otherwise would be. Carbonate of lime seems to be rendered more soluble by the presence of sulphate of potash and chloride of potassium. (Ludwig Gmelin, Hand-book of Chemistry.)

On the other hand we know of the actual displacement of chlorides from solution by other chlorides, as the solubility of chloride of sodium in water diminishes, the greater the amount of chloride of magnesium therein dissolved. Sulphates also affect the relative solubility of the chlorides of sodium and magnesium. In regard to the assumption made here, that silica is driven out as carbonate of lime enters into solution, assuming the structural position of the dissolved carbonate, Bischof says, in his Chemical and Physical Geology (Cavendish Society, Vol. I, p. 199), that " although silica is separated directly from sea water by organic agency, still this separation

may also take place in consequence of a displacement of the sedimentary carbonate of lime and the animal remains contained in it." He further says, "when the carbonate of lime acts as the precipitant to carbonates of magnesia, protoxide of iron and *silica*, in sea water, equivalent quantities of it enter into solution again." All of which can be interpreted as a corroboration of the view given above.

However, the exact method of interchange is described, it can hardly be doubted that the pseudomorphism by which silica assumes the form of crystallized calc-spar is closely or exactly imitated. Von Buch, in his examination of organic silicifications, concluded that the soluble silica deposited from solutions took the place *only* of the organic matter, at least at first, and that the substitution of the silica for carbonate of lime was later, and in this secondary form appeared as warts, concretionary rings, etc. Alexander Petzholdt, in his examination of a silicified belemnite, found that the silicification began on the outside, penetrating progressively through the minute tubes of its structure to the interior, finally effecting a continuous silicification from the inside to the outside. He found the same stages shown in oyster shells; and a section in the center of an oyster shell contained 51.78 per cent. silica and 47.81 per cent. carbonate of lime, with traces of iron oxide, while its exterior was entirely silicified. His observations disproved Von Buch's assumption, and established the fact that the waters carrying silica directly removed the carbonate of lime and so replaced it with opal-material (soluble hydrated quartz), and that no warts, concentric or concretionary rings were formed at all. Whether the replacement by silica of organic tissues, as the structure of wood or the horny apophyses of brachiopods, may involve less obvious conditions than those prevalent in the more ordinary mineral replacement of calcite or aragonite by silica, or not, still the formal character of the substitution is similar. Bischof, in commenting upon this similarity, says, "the penetration of the silicic acid in the minute interspaces of the fibrous carbonate of lime, as also all the appearances presented by the silicified molluscan shells, agree so completely with the penetration of the calc-spar by silicious substances,

and with the entrance of the silica between the cleavage plains of the same, that doubtless we have here one and the same process of alteration. Therein, however, there is a difference between the displacement of the carbonate of lime in the molluscan shell and that in the calc-spar, in so far as the latter is frequently hollow and the former not; in the shell the space of the removed carbonate of lime is entirely, in the calc-spar only partially filled. We might ascribe this difference to the well-known inclination of silicic acid to unite itself with organic substances, if the amount of organic matter were not so small. The true explanation of this difference must await further investigations" (Chemischen and Physikalischen Geologie).

This latter contrast in the silicification of fossils and the pseudomorphism of calc-spar seems to arise principally from contrasted quantitative conditions. The solid replacement of the carbonate of lime in fossils by silica is connected with the former's slow solution, as compared with that of exposed crystallized calcite, which may be rapidly invaded by carbonated or acid waters, whereas the imbedded fossil receives the access of terrestrial waters but slowly, and also retains its carbonate of lime somewhat intermixed with organic envelopes, the sarcodic filaments that penetrate the hard parts of invertebrates, and so surrenders it to solution less quickly, with the result of acquiring a dense and complete molecular replacement. In regard to the view of the solution of carbonate of lime in water expelling its dissolved silica Bischof remarks, that in the case of the hollow crystals of calcite we are shown how the water has dissolved and removed more easily the soluble carbonate of lime than it has deposited the less easily soluble silica, an expression, which, from the point of view taken here, is simply equivalent to saying, that the amount of silica in the waters of solution was insufficient to fill the space occupied by the calcite. Subsequent crystallization of silica within these hollows would simply produce drusy surfaces on a crystalline texture of interlocked crystals. Fossils also undergo so-called secondary replacement, when their forms become distorted and rough, and little circular monticules of silica are distributed over and through their shells and skeletons. This "orbicular silica"

(Beckite markings) is customarily assigned to the later periods of the fossils change, whereas the intimate replacement of the microscopic structure took place in the earliest stage of its inhumation.

In the Trenton limestone of Wisconsin, a more or less magnesian rock, holding from one to three per cent. of soluble silica, the molluscan forms are replaced by silica, forming hard brittle pseudomorphs of much beauty; and in the Trenton beds of Tennessee we find the corals frequently or universally silicified by secondary silicification (Columnaria, Tetradium, etc.). It would seem that the silicification of fossils, where it is of a minute and very accurate character, must have been begun before the consolidation of the limestone itself, and have been completed before the layers assumed their final lithological state. But some peculiar instances of an apparent progressive silicification continuous with the weathering of the enveloping rock, are known as where, in the Niagara limestone in western New York, fossils appear in relief above the surface of the dissolved limestone, and are seen to be complete siliceous replacements, the parts of the same fossils, or other similar fossils, enclosed within the rock a short distance below its surface, being entirely dissolved when placed in acid, evincing their calcareous nature. If this is true, the replacement must take place from the soluble siliceous constituents of the rock, which are slowly introduced into the calcareous tests and frame-work of fossils as these are dissolved in carborated waters. It would seem more likely, in most cases, as in the very siliceous and ferruginous Schoharie grit,[1] that silicification has been already partially effected, and that the action of natural solvents is to remove the associated calcareous particles and leave the siliceous residue as the representative of the fossil, somewhat less

[1] In this formation the shells of fossil bivalves are often removed by solution, being almost entirely carbonate of lime; and the siliceous filling, colored brown by the ferruginous oxydation, remains as casts of their interiors. But in other cases silicification has partially replaced the shells, and fragments of these taken from unweathered portions of the rock show upon solution in acid siliceous scales, which remain undissolved. In the Trenton of Teneessee the weathered siliceous shell of gasteropods is continuous with the siliceous parts yet plainly seen imbedded in the unweathered limestone.

dense in texture, but a substantial and complete form. In fact, in the case of many specimens of weathered fossils, where the siliceous shells project in high relief above the limestone matrix, the surfaces of the shell are finely perforate, or small holes occur, as if the limestone had been removed from these spaces and the intervening areas of silica remained imperfectly continuous. Silicification seems to have gone on with great energy and completeness in some beds in the same formation in which other beds show but imperfect traces of its action, and this may be ascribed to a greater proportion of soluble silica, and perhaps as well to the presence of organic structures more susceptible to siliceous replacement. As regards the first course, it is true that mere excess of a quartzose matrix does not necessarily facilitate silicification, as we see in the Oriskany sandstone, which is so frequently characterized by cavities from which fossils have been dissolved by carbonated waters, though each one of those cavities is surrounded by sandstone. The extraction of this silica could not in this case be effected so as to replace the calcareous parts of the dissolved fossils, because of its insoluble nature. Soluble silica, that colloidal form which is more readily taken in solution, must be provided, for the substitution of the lime portions of fossils. As regards the second cause, it seems certain that thin and delicate tests or structures, as the septa and tabulæ of corals, the partitions and walls of bryozoans, and the fibrous texture of some brachiopodous shells are more susceptible to replacement by dissolved silica than the valves of lamellibranchs or the whorls of gasteropods.

Sorby has called attention to an interesting siliceous replacement in the calcareous grit below the coralline oolite in England, where very small reniform bodies occur, converted into agate or presenting microscopic geodes, whose interior walls were lined with an agate film. Sometimes these reniform bodies are filled with calcareous spar, and these contrasted fillings are seen in the same slide side by side. Whatever these enigmatical bodies really are (Sorby was inclined to regard them as foraminiferous), they illustrate the minute way in which silicification acts, for they are on an average about $\frac{1}{200}$

of an inch in diameter, which would give nearly three million in a cubic inch. In the perforated walls of the favosite corals, where the entire skeleton of the fossil has become silicified, the minute pores are sometimes surrounded by little siliceous mammæ, which seem to have gathered under the influence of a form of concretionary concentration.

The peculiarities of preservation of the delicate internal appendages of brachiopods varies extremely, and while specimens of the same genus or species from one locality refuse to disclose their loops or spiral arms to the paleontologist, those from another, even with indifferent care and easier methods, are readily examined. Thus, the Devonian *Centronella* from England afforded imperfect preforations of the loop, etc., to the Rev. Mr. Glass, even with excessive nicety of treatment, whereas those from Michigan, by simply fracturing them in different directions, established the accuracy of Prof. Winchell's descriptions. In alluding to this Dr. Davidson says, "ordinarily by this process no certain result can be obtained, and none could be obtained in this manner from our Devonian specimens of the same genus. But in these (the American) specimens of *C. Julia* there is sufficient contrast between the color of the loop and the surrounding matrix to make the different parts of the loop very clear when revealed opaquely and by fracture. In most of the specimens the loop is of a rusty-brown color surrounded by a lighter matrix." Again, the *Athyris* of our Devonian is apt to be filled with a dark spar, which, being impervious to light, yields unsatisfactory results, whereas those of the English Carboniferous are filled "with a spar beautifully transparent and peculiarly favorable for working." This is by no means universal, as Prof. Whitfield has displayed the spires of *Athyris spiriferoides* in exquisite perfection in the Hamilton slate specimens. It is singular that, as stated by the Rev. Mr. Glass, the English fossil brachiopods never—or very rarely—exhibit a silicification of the spires in a calcareous matrix, whereas this frequently occurs in the United States, rendering the development of these delicate appendages comparatively simple, and incomparably beautiful.

Few organisms are provided with a siliceous frame-work, and except the radiolarians and the sponges animal life has

limited its process of universal secretion to creating skeletons and coverings of carbonate of lime, in which there has also been mingled in many instances phosphates and occasionally corneous layers of an indeterminate mineral and organic character. Most of the fossils we are required to study originated in calcareous bodies, and were originally deposited as such, and for the most part they as fossils retain their calcareous substance to-day. A mineralogical change, however, has in many cases supervened, and the carbonate of lime, known as aragonite, which formed many shells when occupied by their living tenants, has become changed to the more stable form of the same salt, calcite. This change has been often hastened by pressure and heat, and even, perhaps, by perturbations of the earth's crust, which have reassorted the molecular units and brought them into the secondary state of equilibrium known as calcite. Sorby has shown that the calcareous portion of organisms is at first deposited in the form of granules of variable size. These "afterwards undergo more or less of crystalline coalescence. In some cases this scarcely occurs at all; but in others it does to a very considerable extent during the life of the organism, and this produces a great difference in the character of the particles into which it is resolved by decay. The falling to powder that then takes place is the result of the oxidization and removal of the organic portion, and, if no crystalline coalescence had occurred, the shell or other body might be resolved into the very minute ultimate crystalline granules; whereas, if much coalescence had taken place, it would break up into much larger ones, showing in many cases its minute structure." These observations were made with reference to the condition of the shells of Lymnæa and other fresh water molluscs in marls, but doubtless apply to the shells of marine formations, and may explain the fragmentary state of shells in limestones, while it points to an agency in preparing the calcareous mud in which they are embedded, though this latter arises more generally from partial solution of shells in carbonated water. A remarkable form of replacement occurs in calcareous fossils, as it has been shown by Zittel, Hinde and Sollas that the soluble silica of the siliceous skeletons of the

flinty sponges is removed, and its place taken by carbonate of lime, or by oxide and sulphide of iron. The secondary character of this lime seems also proven by the fact that it is always crystalline, and its crystals are placed confusedly in all directions, and not in one, or, as it is technically expressed, are *unoriented.*

Prof. Nicholson, in his study of certain obscure organisms known under the general designation of Stromatoporoids, has indicated three different conditions or phases of their preservation. These organisms are in the main calcareous encrusting or turbinate masses, built up by a succession of poriferons sheets or laminæ, between which irregular spaces extend, furrowed by inosculating canals. In the first state of preservation, instanced by this author, the actual calcareous skeleton is preserved, and all cavities are infiltrated with transparent calcite, the skeleton then appearing as a brown granular or cloudy non-crystalline body. In the second method of fossilization more or less silicification has taken place, the cavities becoming solidly silicified and the skeleton remaining calcareous, or the skeleton irregularly presenting a complete siliceous frame-work. In the third method the specimens are preserved in limestones or in argillaceous deposits. The skeleton became infiltrated with fine mud or argillaceous sediment, and was dissolved out, being the less stable form of carbonate of lime—aragonite—and was replaced by calcite. Thus, the skeleton appears as clear as calcite, while the chambers, pores and canal-system of the fossil are represented by comparatively opaque calcareous mud or fine argillaceous fillings. In the skeletons and hard parts of living invertebrates the following distinctions of mineral composition have been determined :

The calcareous foraminifera are composed of calcite, with some aragonite.

The true corals are composed almost entirely of aragonite.

The alcyonarians are for the most part composed of calcite, with small amounts of aragonite and phosphate of lime.

The echinoidea are essentially formed of calcite.

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The hard parts, exoskeletons, of crustacea contain varying intermixtures of calcite and phosphate of lime.

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The brachiopoda have shells composed of calcite and some phosphate of lime, the latter salt being almost limited to the shells of the inarticulate division of this class—*lingula crania discina*, etc.

In the lamellibranchs there is found some variation in the composition of shells of different genera, in some the shells are wholly aragonite, in oysters and scollops (*Ostrea, Pecten*) the shells are calcite, whereas in mussels Mytilus and Pinnas, the outer layer is calcite, the inner aragonite.

SOME MANITOBA CLADOCERA, WITH DESCRIPTION OF ONE NEW SPECIES.[1]

BY L. S. ROSS.

No record is to be found among the literature upon Entomostraca, of any systematic work done upon this interesting division of the Crustacea in Manitoba or any of the Provinces of Canada. The region is yet open to the student of the distribution of the group. A short stay in the Province of Manitoba in June, 1895 was utilized by the author in making a few collections from the region about Portage la Prairie on the Canadian Pacific Rail Road fifty-five miles west of Winnepeg. Before leaving the province some vials of alcohol were left with a resident of the town to be filled with collections. A vial was received every second week from the time of the visit until cold weather, the latest being filled Oct. 21, 1895. One vial remained to be filled the following spring.

Collections were taken by the author from the Assiniboin River, from a deep weedy slough which was once the channel of the Assiniboin River, from railroad ditches and from prairie

[1] **Read before the Iowa Academy of Sciences, Dec. 1876.**

pools and ponds. A hurried visit to Lake Manitoba gave opportunity for a few hauls of the net among the rushes along the shore.

An examination of the material obtained shows the presence of thirty species and varieties, one of which, and possibly two, is a new addition to the list of described species.

The forms belong to the following families:

Sididæ	1
Daphniidæ . . .	9
Bosminidæ . . .	1
Macrotrichiidæ .	4
Lynceidæ . .	13
Polyphemidæ . .	1
Leptodoridæ . .	1
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The distribution of the species is given in the following table:

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Ceriodaphnia consors (?) Birge.
Iliocryptus sp.?
Chydorous sphæricus O. F. Müller.
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Pleuroxus excisus Fischer.
Pleuroxus sp?

Chydorus sphæricus O. F. Müller.
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Prairie Slough Near Portage la Prairie.

Daphnia pulex var. pulicaria Forbes.
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Sida crystallina P. E. Müller.
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Alona quadrangularis O. F. Müller.
Pleuroxus denticulatus Birge.

Pleuroxus procurvus Birge.
Chydorus sphæricus O. F. Müller.
Camptocercus rectirostris Schœdler.
Polyphemus pediculus Linnæus.

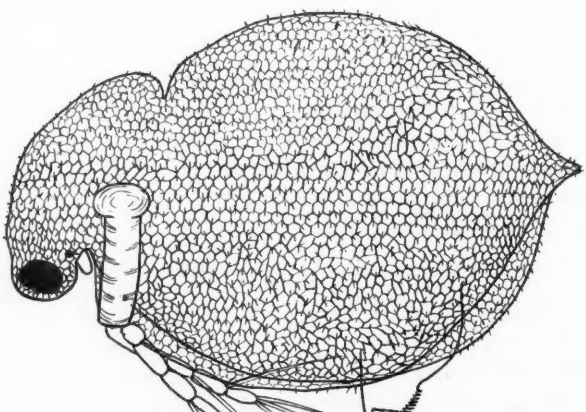
Lake Manitoba.

Bosmina longirostris O. F. Müller.
Chydorus sphæricus O. F. Müller.
Leptodora hyalina Lilljeborg.

Description of a New Species.

Ceriodaphnia acanthina.

The body is large, rounded, with the valves of the shell forming a well developed posterior spine. The head is separated from the body by a very deep depression. Head is low,



Ceriodaphnia acanthina ♀

small, rounded in front of the eye, sinuous above and angled between the eye and the antennules; the lower margin is nearly in a line with the lower margin of the valves of the shell.

The shell is very strongly reticulated with small very sharply marked hexagonal reticulations measuring about .016 to .021 mm. across. Small sharp spines project from the angles of the reticulations, many at nearly right angles with the surface of the shell. In the possession of these spines this species closely resembles *C. setosa* Matile. No spines were seen on the rounded front of the head as are usually present in *C. lacustris* Birge. The dorsal margin of the shell is arched, curving gradually into the posterior margin.

The posterior spine of the shell may be near the dorsal margin, or one-third the distance from the dorsal to the ventral margin. When the spine is situated low the posterior shell margin above is slightly concave. The spine is as well developed as in *C. lacustris* Birge, and often ends in blunt teeth, but is not divided into two parts at the end as is sometimes the case in that species. The posterior margin of the shell curves gradually into the strongly convex ventral margin. The fornices are greatly developed extending almost the width of the shell. They are almost as broad but are not so sharply angled as in *C. lacustris* and do not end in sharp teeth.

The antennules are short and thick, reaching to or a very little beyond the angle behind the eye. Setæ are present toward the distal end. The antennæ are long and rather slender; the setæ reach nearly to the posterior margin of the shell.

The post abdomen is of moderate size slightly tapering toward the end and is armed with nine to eleven strong recurved spines of nearly equal size except the first and last which are smaller. The anal claws are, long, curved, and denticulate on the inner side with minute teeth of two sizes. The teeth of the basal two-fifths of the claw, some forty or fifty in number, are two or more times longer than those of the distal portions.

The eye is of moderate size, situated near the margin of the head or back a short distance from the margin. The lenses do not project far from the eye pigment. The pigment fleck is small, rounded, and situated back of the lower portion of the eye at a distance approximating half the diameter of the eye.

In general shape the species resembles *C. rotunda* Straus. The posterior spine is not as near the dorsal margin as Kurtz

figures it in *C. rotunda,* but is in nearly the same position as in a specimen examined of that species identified by G. O. Sars of Norway. The reticulations are as distinct and the double contoured markings (due merely to depth of reticulated areas) mentioned by Herrick and used in his key, are fully as prominent as in *C. rotunda.*

The reticulations and the minute spines on the surface of the shell are very like those described and figured by Matile in *C. setosa.* The measurements of *C. setosa* are but little over half those of *C. acanthinus.* Matile's description of *C. setosa* gives the length .42 to .54 mm. and the height .27 to .36 mm. while *C. acanthinus* measures from .80 to 1 mm. in length, and .70 to .77 mm. in height. The head of *C. acanthinus* is larger and extends nearer to a level with the ventral margin of the shell. Some specimens of *C. reticulata* taken from the same slough at the same time have the reticulations nearly as distinct as in *C. acanthinus* and also possess minute spines upon the surface of the shell. The two species are distinct, however, because of differences in the shape of the body, and of the difference in the armature of the anal claws.

The males were not seen. The mature females measure from .80 to 1. mm. long and .70–.77 mm. high. Found in abundance in a weedy slough in late May, 1896 at Portage la Prairie.

Notes on Some of the Species.

Sida crystallina : Was taken only from a deep weedy slough at Portage la Prairie.

Ceriodaphnia reticulata : Was in a bottle sent in May, 1896 from the slough at Portage la Prairie. The specimens have the reticulations very sharply marked. Some show numerous short spines at the angles of the reticulations. The number of spines on the anal claw varies somewhat. This species was found with *C. acanthinus.* It differs from the typical *C. reticulata* in the distinctness of the reticulations and in the presence of spines on the shell in some individuals.

Ceriodaphnia consors : Numerous specimens were found at various places which are with much hesitation referred to this species.

Scapholeberis angulata: Was taken only in small numbers, a few being found in Rat Creek on Portage Plains.

Daphnia pulex var. *pulicaria:* Was found in small numbers in a prairie slough near Portage la Prairie.

Simocephalus daphnoides (?) The body is robust, with greatest height a little behind the middle. The head is rounded in front and has no spines. Lower margin of the head is slightly concave, straight, or even slightly convex to the base of the short beak which may project at nearly a right angle to the lower margin of the head. The head is separated from the body by only a very slight depression. Depth of the head in one specimen is .077 mm.; length from the posterior margin of the base of the antennæ .052 mm. The head has a daphnia-like appearance. The ventral margin of the shell has few very short blunt teeth. The posterior margin from short blunt posterior spine toward dorsal margin has teeth better developed than those on the ventral margin. The dorsal margin teeth continue forward a short distance. The posterior spine is very short, blunt, armed with short teeth and is situated little above the middle of the posterior margin.

The eye is of moderate size, situated near the front of the head or at a short distance from the front, and at a distance from the lower margin equalling one-half the diameter of eye, or at a distance slightly greater than diameter. Pigment fleck is irregular in shape; elongated, rhomboidal and oval forms were seen. Pigment fleck is small, situated near the posterior margin of the head.

Specimens measured vary in length from 2.04 mm. to 2.53 mm.: in depth from 1.20 mm. to 2.04 mm.

The description of *S. daphnoides* as given by Herrick in AMERICAN NATURALIST, May, 1883, and in Entomostraca of Minnesota, is rather brief. Herrick states that the form is found only south of the Tennessee River; but a comparison of specimens taken in Manitoba with the original drawings and brief description in the AMERICAN NATURALIST makes it appear that the form is found even in that northern province.

Lilljeborg's "Crustaceis" published in 1853 gives drawings of *S. vetulus* with the lower margin of the head as nearly

straight as in the figures by Herrick of *S. daphnoides*, and the general outline of the body almost as daphnia-like in appearance.

Eylmann in the "Berichte der Naturforschenden Gesellschaft zu Freiburg" Zweiter Band, Drittes Heft, published in 1886, figures the lower margin of the head of *S. vetulus* straight to the short beak, and the body with greatest height at the middle. A specimen of *S. vetulus* identified by G. O. Sars, of Norway, and examined by the author has the lower margin of the head straight to the very short beak and the eye situated at a distance from the lower margin equal to about one-half the diameter of the eye.

Herrick says in his description that the curved spines present in the other species at the caudo-ventral angle of the shell are absent from *S. daphnoides*. If this be constant it seems to be the only character not possessed by specimens of *S. vetulus*.

The specimens taken in Manitoba, and also in Iowa, vary in size, and shape of the head and of the body; there are such grades of variation, and authors figure such differences of form in *S. vetulus;* that it seems very probable that *S. daphnoides* is merely an extreme form of *S. vetulus*.

Bosmia longirostris: Found in only two collections; one from Lake Manitoba and the other from a slough at Portage la Prairie.

Macrothrix laticornis: This species was met with only in a shallow prairie slough and was by no means abundant.

Bunops scutifrons: This beautiful species was found rather frequent in the shallow prairie slough at Portage la Prairie.

Iliocryptus sp.?: A few shells and one individual of this genus were taken from the Assiniboin River. The species is probably longiremus Sars.

Alona quadrangularis: Alona costata: There is some question as to the identification of these two species. Only a single individual of each was found. The specimen that may be *Alona costata* is not strongly striated but other characteristics agree with descriptions of this species.

Graploleberis testudinaria var. *inermis*: Although taken at three different places this species was rare. A few individuals

were found in Rat Creek, one in the collection from the Assiniboin River, and one individual and a few shells from a prairie slough.

Dunhevedia setiger: This species is apparently rare during the season of the year the collections were taken, as only a few specimens were found. They were taken from a prairie slough. Birge, in his "List of Crustacea Cladocera from Madison, Wisconsin," mentions the fact of *D. setiger* being one of the rarest of Cladocera in that region, but that in the month of August he found them in immense numbers, both males and females.

Pleuroxus sp ?: The shell is long and low, in some specimens evenly arched from the posterior dorsal angle to a point a little in front of the brood chamber from which the curve is flattened slightly to a distance including the basal third of the long sharp rostrum. In others the dorsal margin is evenly arched from the postero-dorsal angle to the rostrum. The head is small, high, with the long sharp curved rostrum far from the anterior margin of the shell, parallel with it and reaching nearly to a line with the ventral margin of the shell. The ventral margin is straight for two-thirds of its length from the anterior margin; the remaining third curves gently upward and has a single small tooth pointing backward, a little in front of the sharp curve into the posterior margin. The ventral margin has long pectinated setæ becoming shorter toward the posterior end of the shell. The anterior margin has setæ for a short distance from the ventral margin. A blunt posteriorly directed projection is formed by the postero-dorsal angle of the shell.

The post abdomen is long, slender, truncate, tapering toward the end. The posterior edge is slightly concave and is armed with about 18 to 20 or more small spines. The spines at the distal end of the series are much the longer and stronger. Anal claws are pectinated, long, and slightly curved. The second basal spine is longer than the first.

The eye is of moderate size. Pigment fleck is about one-half as large as the eye and is situated one-fourth the distance from the eye to the end of the rostrum. The antennules are cylindrical with setæ at the end and a lateral seta. Length of

antennule about equals the distance between the eye and the pigment fleck. Antennæ are short, small, with long setæ.

The specimens do not agree in all respects with the descrigtion given by Birge of *Pleuroxus gracilis* var. *unidens,* but do agree in many points. The largest specimen found measures .60 mm. in length by .38 mm. in height; another measures .60 mm. long and .33 mm. high. Birge gives a measurement of .85 mm. by .46 mm. and states that the species is the largest yet seen. The original description of *P. gracilis* var. *unidens* states that, "the striation is very plainly marked. The specimens found by the author are only very faintly striated and that most distinctly at the anterior part of the shell where the lines of striation are approximately parallel to the anterior margin. The larger part of the surface is free from markings, either striation or reticulation as far as could be observed. The shell is more arched dorsally than *P. gracilis* is figured by Matile. Birge's description of *P. gracilis* var. *unidens* says: "The upper posterior angle is prolonged into a projection, quite characteristic, seen, I believe, in no other species."

In the specimens found there is a slight projection, at the angle but not so pronounced as figured by Birge and by Herrick. The lower posterior corner is rounded and has a small tooth anterior to it as in *P. gracilis* var. *unidens.*

It seems improbable that the differences between the specimens, and the description and drawings of *P. gracilis* var. *unidens* should fall within the range of variation of a variety. The males were not seen. Collected in small numbers in June, 1895 from a shallow slough and a small creek.

Pleuroxus excisus: Only one or two individuals were observed. These were taken from Rat Creek, a sluggish stream flowing into Lake Manitoba.

Alonopsis latissima var. *media:* The specimens resemble the species described by Birge but have some points of difference.

Birge's description is as follows: "Rostrum prolonged, and shell sharp, somewhat quadrangular in shape, marked by striæ. The dorsal margin is convex, the hinder margin nearly straight. Its lower angle is rounded and is without teeth. The lower margin is concave and has long plumose setæ. The front margin is strongly convex. The postabdomen is long

and slender, resembling that of Camptocercus, and is notched at the distal extremity; it has two rows of fine teeth and some fine scales above them. The terminal claws are long, slender, with a basal spine in the middle, and are serrated. The antennules are long and slender, but do not reach to the end of the rostrum. They have each a flagellum and sense hairs. The antennæ are small and have eight ($\frac{300}{311}$) setæ and two ($\frac{100}{100}$) spines. The labrum resembles that of *A. leucocephalus*, but is slightly prolonged at the apex. The intestine, cæcum, and color resemble those of Acroperus. There is a trace of a keel present on the back."

Herrick's statement, in part, is as follows: "The specimens seen in Minnesota resemble this species, (*A. latissima* var. *media*) very nearly, apparently, but there are some differences. The terminal claw has an increasing series of spines to the middle; there seems to be no lateral row of scales beside the anal teeth; the abdomen is rather broad at the base and narrows toward the end. The shell is not square behind. The lower margin has a few long hairs anteriorly which are followed by a series of teeth, and in the concave part a somewhat longer set to a point just before the lower curved angle."

In most respects the Manitoba specimens agree more nearly with Herrick's description than with Birge's. A few points of difference are noted. In the Manitoba specimens a few long hairs are present on the lower margin anteriorly, then at a little distance posteriorly from the hairs are short sharp bristles, hardly heavy enough to be called teeth, becoming largest on the concave part of the margin. In one specimen the end of the abdomen is deeply cleft, the posterior lobe bearing four very strong teeth of nearly equal size.

Herrick says that hexagonal reticulations are seen upon the shell of the embryo yet in the brood sac. In several sexually mature females observed faint reticulations are present, more distinctly seen near the ventral margin.

Polyphemus pediculus: This species was found to be quite common in the Portage Plains region. It has not been reported from Iowa, and Birge says it is not common in southern Wisconsin. Although reported from Georgia it seems to be more commonly found in the north.

THE FLORIDA SEA-MONSTER.

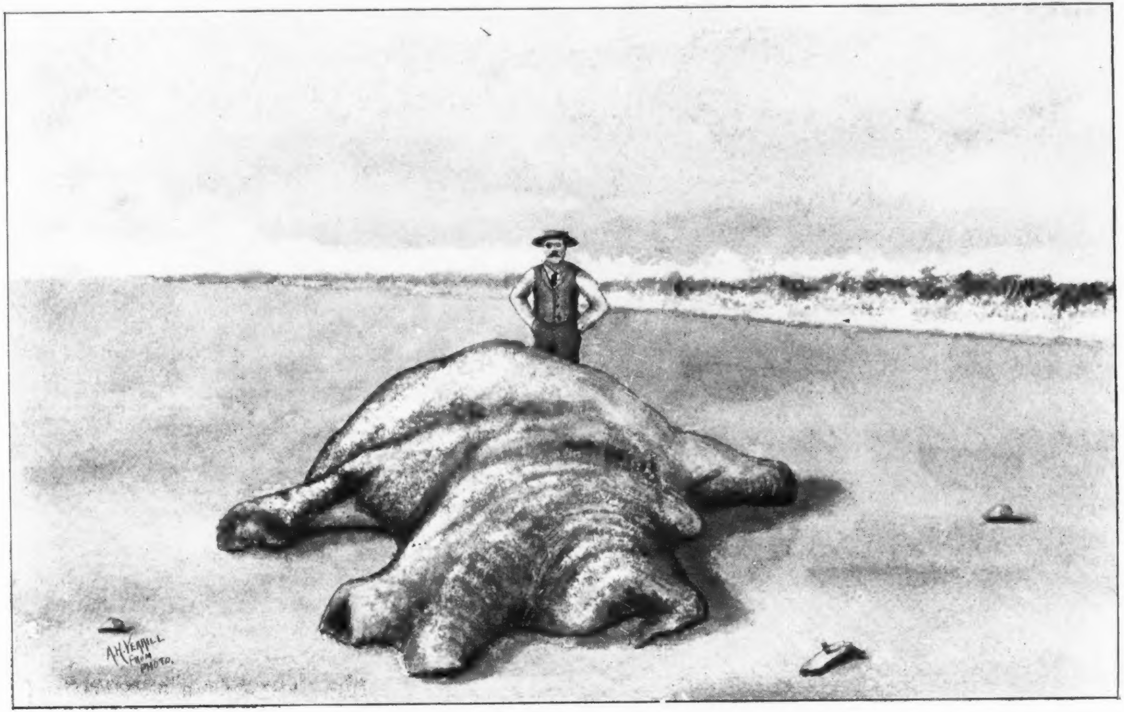
BY A. E. VERRILL.

On the 5th of December, 1896, a portion of a very large marine animal was cast ashore on the beach twelve miles south of St. Augustine, Florida. When it first came ashore it was much mutilated at one end, and had evidently been dead some time, and was, apparently, in an advanced state of decomposition. Contrary to expectation, it has resisted further decay, and still remains, after more than three months, nearly in the same state as at first. It was first brought to my notice by Dr. De Witt Webb, who has devoted a great amount of time and labor to its investigation and preservation. Through him I have received a dozen different photographic views of it, taken at different times, and showing it both in its original state and when it had been moved and partly turned over. Quite recently he has sent me several large masses of the thick and firm integument, of which the mass is mainly composed. By his efforts it has recently (with much labor) been moved several miles nearer to St. Augustine, to the terminus of a railroad, and protected from the drifting sand. It is likely to keep some months longer without much change, and to be visited by large numbers of people. The figures now given are copied from photographs made two days after it came ashore. At that time the sand had collected around it to the depth of about eighteen inches.

Its length is 21 feet; breadth about 7 feet; height about 4½ feet, when the sand was removed. It weight was estimated at about 7 tons.

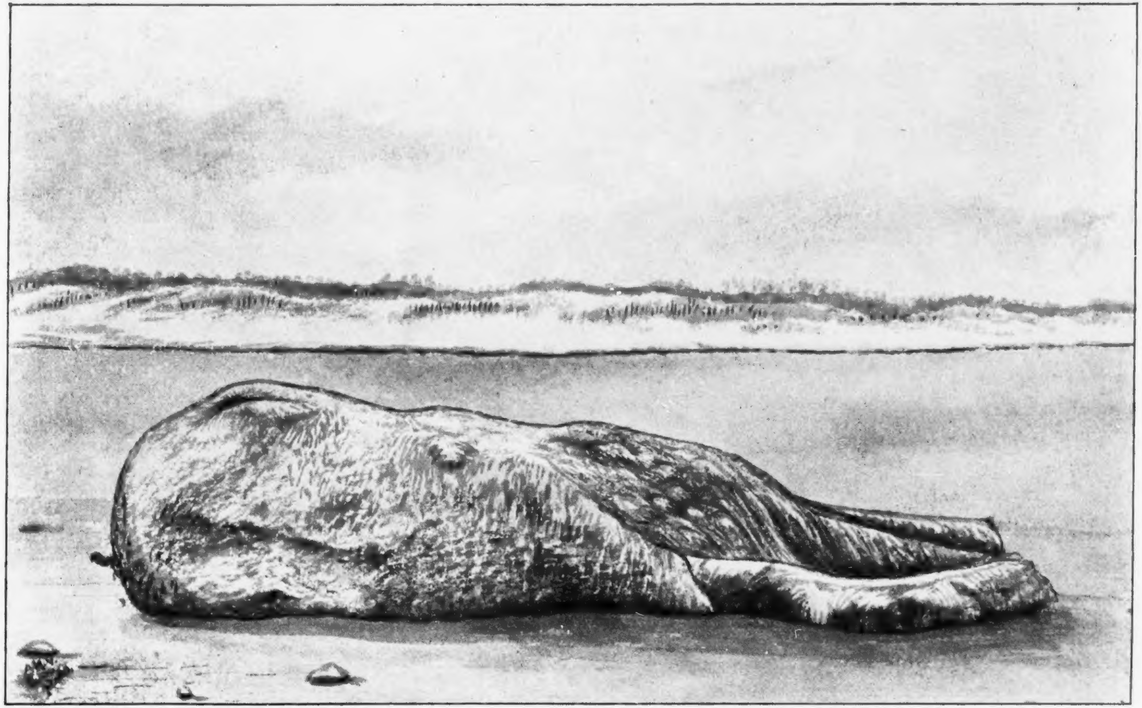
As shown by the figures, it has an elongated, pear-shaped form, broadly rounded at the larger, closed end, and considerably flattened toward the smaller and much mutilated end. At this end, as shown in both views, there are large, divergent ridges covered by the frayed-out fibrous tissues. These ridges are folds of the integument, but were at first mistaken for the stumps of arms, like those of an *Octopus*, and were so described

PLATE VII.



The Florida Monster, end view, from a photograph.

PLATE VIII.



The Florida monster, side view, from a photograph.

in letters received by me. Moreover, Mr. Wilson who visited it, when first found, claimed to have found a portion of an attached arm, 36 feet long, buried in the sand. This last statement, in the light of later investigations, must have been erroneous and was entirely misleading.[1] At that time, however, it seemed quite consistent with the form and appearance of the mass, which was described by Dr. Webb as closely similar to the body of the common small octopus. The photographs show this resemblance very clearly ; and the ridges at the mutilated end, then supposed to be the stumps of mutilated arms, seemed to confirm the view that the mass was the mutilated body of a huge octopus,[2] and as such it was described by me in the *American Journal of Science* and elsewhere.

As soon as specimens of the tissues were sent to me, even a hasty examination was sufficient to show that this view was not correct, for instead of being composed of hardened muscular fibers,[3] as had been supposed, the thick masses of tissue were found to consist almost wholly of a hard, elastic complex of connective tissue fibers of large size. The masses sent vary from four to ten inches in thickness. They are white, and so tough that it is hard to cut them, even with a razor, and yet they are somewhat flexible and elastic. The fibers are much interlaced in all directions, and are of all sizes up to the size of coarse twine and small cords. The larger fibers unite to form bundles extending from the inner surface radially. According to Dr. Webb, who opened the mass, these cords were attached

[1] The memoradum written by Mr. Wilson and forwarded to me by Dr. Webb is as follows: "One arm lying west of body, 23 feet long; one stump of arm about 4 feet long; three arms lying south of body and from appearance attached to same (although I did not dig quite to body, as it laid well down in the sand and I was very tired), longest one measured over 23 feet, the other arms were three to five feet shorter."

[2] This was also the opinion of a large number of naturalists who saw the photographs sent to me.

[3] A highly contractile muscular integument is an essential feature of all cephalopods.

Statements that the creature cannot be an Octopus, but is of cetacean nature, were published by me in several local daily papers within a day or two after the specimens were first examined by me, and shortly afterwards in the *New York Herald* and in *Science*.

in large numbers to a central saccular organ, which occupied a large part of the interior of the thicker part of the specimen. This might, perhaps, represent the spermaceti case. Naturally most of the interior parts had decomposed long before it was opened,[4] so that we lack details of the interior structure. Externally there is but little trace of cuticle. The surface is close-grained and somewhat rough, with occasional gray patches of what may be remnants of the outer skin, much altered by decay. The thick masses contain a slight amount of oil, and smell like rancid whale oil, but they sink quickly in water, owing to their great density. No muscular tissue was present in any of the masses sent, nor were there any spaces from which such tissues might have disappeared by decay.

It is evident that such a dense and thick covering of fibrous connective tissue could not have come from any mobile part of any animal, but must have served for passive resistance to great pressure or concussion.

The structure of this integument is more like that of the upper part of the head of a sperm whale than any other known to me, and as the obvious use is the same, it is most probable that the whole mass represents the upper part of the head of such a whale, detached from the skull and jaw. It is evident, however, from the figures, that the shape is decidedly unlike that of the head of an ordinary sperm whale,[5] for the latter is oblong, truncated and rather narrow in front, "like the prow of a vessel," with an angle at the upper front end, near which the single blow-hole is situated. No blow-hole has been discovered in the mass cast ashore. There is a depression, shown in the side-view, near the large end, that I at one time thought

[4] It should be stated that after visiting the specimen, two days after it came ashore, Dr. Webb did not again see it for several weeks, owing to very stormy weather and its distance from St. Augustine. Nor did anyone suppose, at that time, that its tissues could be preserved or utilized for study, owing to its apparently advanced decomposition. The outer skin rapidly decayed, but the fibrous mass seems very durable.

[5] The dimensions of the head of a large sperm whale, 84 feet long, are given as follows: Length, about 25 feet; depth, 8 to 9 feet; breadth, 5 to 6 feet. The blow-hole is like a slit, about a foot long, and has a sigmoid curve. It is on the left side, close to the tip of the nose. The spermaceti case occupies a large space within the right side of the head. It is supported by strong fibrous tendons.

might be a blow-hole; but Dr. Webb states, that it is a "sulcus" or pit about two feet long and six inches deep, apparently not connected with the interior cavity and probably due to mutilation. The specimen was doubtless floated ashore by the gases of decomposition accumulated in the interior cavity, indicating the absence of any free external opening to it, from which the gases could escape.

Photographs made of the under side of the thicker part, when it was turned up by powerful tackle, show an irregular roughness on that side, extending well forward, but not to the end. This roughness may be due to abrasion, or it may show where the skull was attached. If the mass really came from the head of a sperm whale, it would seem that it must have projected farther forward beyond the upper jaw than does the nose of an ordinary sperm whale, and it would, apparently, have been much broader and blunter, or "bottle-nosed." It is possible, of course, that its form has changed considerably since death; but in view of its wonderful toughness and firmness, no great change of the larger end, supposed to be the anterior or nose-end, is probable. All the pulling and hauling and turning of it partly over, by the aid of six horses and strong tackle, have not served to change its shape materially, or rather its elasticity serves to restore it to its former shape. Its toughness and elasticity remind one of the properties of thick vulcanized rubber.

It is possible to imagine a sperm whale with an abnormally enlarged nose, due to disease or extreme old age, which, if detached, might resemble this mass externally at least. It seems hardly probable that another allied whale, with a big nose, remains to be discovered. Notwithstanding these difficulties, my present opinion, that it came from the head of a creature like a sperm whale in structure, is the only one that seems plausible from the facts now ascertained.

EDITOR'S TABLE.

Whatever fair differences of opinion may exist as to the general protective policy of our government, there can be among intelligent people no two opinions as to the provisions in the new Dingley tariff bill, taxing books, apparatus and antiquities imported into the country. A more extraordinary anachronism than these provisions, can scarcely be conceived. With few exceptions since 1789, books, philosophical apparatus, etc., imported for the use of colleges, libraries, and other incorporated institutions, have been admitted free of duty; and within a few years, through representations of various scientific bodies, scientific books in other than the English language imported for the use of private students were also placed on the free list. It was insisted that if institutions should have their books free, private students were still more intitled to such consideration.

The proposed legislation reverses all this, and puts us in the position as to enlightenment, which we occupied prior to 1789, and below that of any existing nation civilized or uncivilized. It shows that the supposed interest in public education professed by such legislators is a sham, and that they are willing to see their fellow countrymen fall below the generally too prevalent level of mediocrity to something still less noble. Probably they do not conceive of the possibility of such a degeneracy, but the opinion held by a people that they are the greatest and wisest on earth, is generally inversely as the truth of the assumption. The more ignorant a man or a nation, the surer it or he is of its or his superiority. We cannot afford in this country to shut ourselves out from the sources of culture as developed in other countries. The supposition that we benefit even in a financial way by such exclusion is fallacious. Is it necessary to say in this country to men sent to legislate for us, that a piece of scientific or artistic work, or an object of antiquity, having been once produced, cannot be produced again? It is necessary to say to men of sense, that the industries fostered by science and art, as those of the printer, engraver, etc. are developed and not suppressed by the abundant introduction of the works of other countries? In the scientific field the work done here is greatly stimulated by the knowledge of the work done abroad, and our ability to do our own work is largely dependent on it.

In fact all the materials of study and research whether imported by institutions or by individuals should be placed on the free list, and that

whether they be printed in the English language or not, if we are to maintain a place among civilized nations. It is true that we have legislators who object to laws providing bodies for the study of anatomy in our medical schools; and perhaps such as these desire to see the education of our citizens taxed and suppressed in other ways; but it is scarcely possible that a sufficient number of members of our national legislature can be found to support the provisions of the Dingley bill, which will restrict the development of intelligence in this country to the rich, and cut it off from the poor.

Since the above was written protests from many institutions of learning have reached Washington, and it is said have produced some impression. We hope that this may be true, and that education may be fostered by the Dingley bill as well as it has been done under the Wilson bill.

THE present regulations of the Universal Postal Union admit specimens of Natural History to the mails thereof only at letter rates, five cents per half ounce or fraction thereof.

At the International Congress of Zoology, held at Leyden, Holland, in September, 1895, Dr. Chas. Wardell Stiles, official delegate of the U. S. Government, offered resolutions, which were subsequently adopted, that the Swiss Goverument be requested, through its delegate to the Congress of Zoology, to propose to the next International Postal Congress an amendment to the regulations thereof whereby specimens of Natural History shall be carried in the mails of the Universal Postal Union at the rates for samples of merchandise; that an appeal should be addressed to all the delegates and members of the Congress of Zoology to bring this amendment to the notice of their respective governments, so that those governments should instruct their delegates to the Postal Congress to act favorably upon the same; that copies of these resolutions be sent by the Secretary of the Congress of Zoology to all governments forming part of the Universal Postal Union and which were not represented at the Congress of Zoology.

In accordance with these resolutions, Dr. Stiles suggested to the committee of the Academy of Natural Sciences of Philadelphia in charge of the matter of postage on Natural History specimens, that, although it is probable that the U. S. Government will vote in favor of this proposed amendment, seeing that it is the same proposition which the United States had presented at the last International Postal Congress of Vienna, the cause would be helped by the Academy adopting resolutions in favor of this proposed amendment and requesting the

Postmaster-General at Washington to instruct our American delegates to vote in favor of it.

This the Academy has done, but other American scientific bodies should join in the work, adopt similar resolutions and send them to our Postmaster-General that he may know that the students of natural history in the United States eagerly desire such a reduction in postage rates. The next International Postal Congress meets at Washington on the fifth of May next. We hope that all those who are aquainted with the facts will use such means and influence as may be at their command to help in the accomplishment of this end.

For the guidance of those who will aid in the manner suggested, a translation of the original French text of the amendment referred to is as follows :

"Amendment to Article XIX (samples) 4, of the Regulations of Details and Order.

> "5. Objects of natural history, dried or preserved animals and plants, geological specimens, etc., of which the transmission has no commercial interest, and the packing of which conforms to the general conditions concerning packages of samples of merchandise."

If this amendment be adopted by the Postal Congress, specimens of Natural History can be sent to countries of the Universal Postal Union at the rate of one cent for every four ounces.

The directorship of the U. S. National Museum has been acceptably filled by the appointment of Dr. C. D. Walcott director of the U. S. Geologic Survey, but the appointment is said to be a temporary one. Mr. Richard Rathbun has been appointed Assistant Secretary of the Smithsonian Institution. Mr. Rathbun has especial qualifications for the directorship of the U. S. Fish Commission and it is to be hoped that President McKinley will make him his appointee.

RECENT LITERATURE.

Sudworth's Nomenclature of the Arborescent Flora of the United States.[1]—If it were necessary to prove the increase in

[1] Nomenclature of the Arborescent Flora of the United States, by George B. Sudworth, Dendrologist of the Division of Forestry. Prepared under the direction of B. E. Fernow, Chief of the Division of Forestry. [Bulletin No. 14, U. S. Department of Agriculture, Division of Forestry]. Washington, Government Printing Office, 1897. Issued January 21, 1897, 8vo, pp. VIII+319.

the scientific nature of the work done in the United States Department of Agriculture one would have to do no more than compare the book before us with the publications from the same division a few years ago. It is a source of much gratification to American botanists that the botanical publications made by the general government are of the highest character, ranking equal to if not above similar publications from any other country.

Mr. Fernow himself writes the introduction, in which he makes some very pertinent remarks concerning the matter of botanical nomenclature, indicating very clearly the position which he occupies in the nomenclature controversy. He states the matter very concisely as follows: "The essential basis upon which the revision has been made is the so-called 'law of priority,' i. e., for species and varieties the specific or varietal name has been taken up which was first used by the author who first described the plant, and for genera the first established generic name either alone or in combination with a type specific name. In order to avoid obscurity and uncertainty, the publication in which for the first time the binominal nomenclature was used persistently, namely, Linnaeus's Species Plantarum (first edition, 1753) has been made the starting point, in accordance with an expression of the botanists of the Botanical Club of the American Association for the Advancement of Science. Objections have been made to the injustice committed in ignoring earlier names; the objectors overlook that it is not a matter of justice primarily, but of expediency, which leads to the adoption of the law of priority, and it would be inexpedient to go back to an earlier date than the one which firmly establishes our present system of notation."

An examination of Mr. Sudworth's work shows that he has done it with much thoroughness. The citations are very full, and the excellent plan is followed throughout of appending to each citation its date. After a full citation of synonyms the various common names used in different parts of the country are given. This at once shows that what every botanist has believed is true as to the unreliability of such names. Thus we find that the Balsam Fir (*Abies balsamea*) bears the following names: Balsam Fir, Balsam, Canada Balsam, Balm of Gilead, Balm of Gilead Fir, Blister Pine, Fir Pine, Fir Tree, Single Spruce, Silon Pine, and Sapin. The Plane Tree (*Platanus occidentalis*) is known as Sycamore, Buttonwood, Buttonball Tree, Buttonball, Plane Tree and Water Beech.

The following examples will show how the species are treated, and will convince everyone of the great usefulness of the work.

Catalpa catalpa (Linn.) Karsten. *Common Catalpa.*

SYN.—*Bignonia catalpa* Linnæus, Sp. Pl., Ed. 1, II, 622 (1753).
Catalpa bignonioides Walter, Fl. Caroliniana, 64 (1788).
Catalpa cordifolia Moench. Meth., 464, (1794).
Catalpa ternifolia Cavenelles, Desc. Pl., 26, (1802).
Catalpa syringaefolia Sims, in Bot. Mag., XXVII, t. 1094, (1808).
Catalpa communis Du Mont de Courset, Bot. Cult., Ed. 2, III, 242, (1811).
Catalpa catalpa Karsten, Deutsch. Fl., 927 (1882).

COMMON NAMES.

Catalpa (Mass., R. I., Conn., N. Y., N. J., Pa., Del., W. Va., N. C., S. C., Ala., Ga., Fla., Miss., La., Ark., Ky., Mo., Ill., Kans., Nebr., Iowa, Mich., Wis., Ohio, Minn.).
Indian Bean (Mass., R. I., N. Y., N. J., Pa., N. C., Ill.).
Beantree (N. J., Del., Pa., Va., La., Nebr.).
Catawba (W. Va., Ala., Fla., Kans.).
Cigartree (R. I., N. J., Pa., W. Va., Mo., Ill., Wis., Iowa).
Catawba-tree (Del.).
Indian Cigartree (Pa).
Smoking Bean (R. I.).

It remains for me to commend the typography and the uniform decapitalization of specific names. It is a thoroughly good, modern piece of work.—CHARLES E. BESSEY.

Atlas und Grundriss der Bakteriologie und Lehrbuch der speciellen bakteriologischen Diagnostik. Von Prof. Dr. K. B. Lehmann und Dr. R. Neumann. Teil I, Atlas. Teil II, Text. Verlag von J. F. Lehmann, München, 1896.

This is a general work on bacteriology covering much the same ground as Flügge's *Die Mikroorganismen,* but in a very different manner. About 60 of the more common animal pathogenic and saprophytic forms have been studied more or less carefully and re-described according to a pre-established scheme, so that their behavior on all the common media may be readily compared. Many other species are briefly mentioned. These 60 species are figured in the Atlas, and Dr. Neumann, the artist, has been peculiarly happy in some of his representations, if not in all. Streak and stab cultures are given in their natural tints, usually on a black background, the agar or gelatin being represented as absent or black. The Atlas contains 63 colored plates, including more than 600 separate figures, most of which are original.

On table 28 there are two figs. X, one of which is undescribed. On tables 12, 19, 20, 55, etc., some of the figures have been accidentally transposed. Rights and lefts have also been transposed by the lithographer in some cases, as on table 37 II. There are occasional misprints as "stichcultur" for "strichcultur" in tables 41, 43, 44, 56, etc. More important is the fact that several scales of magnification are used in representation of the individual bacteria instead of the generally agreed upon magnification of $\times 1,000$. The Atlas is very attractive and cannot fail to be of much use. What of the text? This consists of 448 12 mo. pages on good paper, in clear Roman type easy to read, very systematically arranged, and with a good index at the end. The greater part of the book is devoted to the detailed description of the 60 species, and much of this part the reviewer has only dipped into here and there. How generally well this part has been done, or how many are the sins of omission and commission can be told only after the book has been used, or by those specially familiar with given organisms. It seems to be a good piece of work. Usually, each organism is described with reference to the following particulars: scientific name, common name, synonyms, literature, microscopic appearance, spores, motility, affinity for stains, need of oxygen, rapidity of growth, gelatine plates (*a.* natural size, *b.* magnified 50 times, 70 times, etc.,), gelatin stab, agar plates (*a.* natural size, *b.* magnified 50 times, etc.,) agar stab, agar streak, boullion, milk, potato, conditions of spore formation, vitality, chemical activities, occurrence, nerve pathogeneis, nearly related species. This descriptive part of the book is preceded by a general discussion of the subject of bacteriology, which certainly deserves praise. In a space of 95 pages Dr. Lehmann has brought together the principal facts respecting the morphology and biology of this group of organisms. His statements are clear, exact, and in the main happy, whether or not one agrees with all of his propositions. One need not expect to find entire up-to dateness in any book. No book can take the place of the current journals, least of all in a rapidly growing science, but this one is so very good that it deserves to find its way speedily into every laboratory. All the way through, in what is omitted as well as in what is brought forward prominently, there is not only evidence of a wide acquaintance with literature and of mature judgment, but also proof that the authors have become familiar with all the details of their subject by long experience in the laboratory. Following the descriptive portion of the book is a useful "Anhang" giving the briefest direction for the microscopic examination of bacteria, staining, preparation of culture media, etc. This will prove helpful to beginners. Finally at the end of the book is a folded sheet

giving in tabular form, so that it may be seen at a glance, some of the principal peculiarities of these 60 organisms, i. e., size, flagella, whether staining by Gram's method, aerobic or anaerobic, liquefaction of gelatin, growth in bouillon, growth in milk, spore formation, pigment on agar, formation of H_2S, indol reaction, amount of acid produced from grape sugar, gas production, growth in CO_2 and finally amount of growth in various media titrated as follows: (1) Neutral to phenolphthalein; (2) No. 1+10 cc. per litre of $\frac{N}{1}$ Na OH; (3) No. 1+10 cc. per litre of $\frac{N}{1}$ H_2SO_4; (4) No. 1+20 cc. per litre of $\frac{N}{1}$ H_2SO_4. Authors have used phenolphthalein for titrating media regularly since 1894 and recommend it for general use. "Jedenfalls kann der mittelst Phenolphthalein neutral hergestellte Nährboden unbedingt als Universalnährboden empfohlen werden." All the bacteria figured in the Atlas were grown on media slightly alkaline to phenolphthalein, and most of the 60 sorts bore the extra 10 cc. of alkali and the 10 and 20 cc. of acid. This seems rather surprising to the writer and certainly cannot be assumed to hold good for all species. My experience would lead me to select for a universal medium a grade of alkalinity considerably less than the zero or neutral point of phenolphthalein, i. e., one nearer the zero of the best neutral litmus paper, as I am satisfied that some species will not grow on media as alkaline as here recommended. In conclusion this book may also be commended to the physician and general reader who wishes to know something about bacteria without becoming swamped in details. Its remarkably low price (15 marks) puts it within the reach of everybody.—ERWIN F. SMITH.

Science Sketches.[2]—This small book of twelve reprints needs little comment. Those who read the sketches in *Popular Science Monthly* and elsewhere will doubtless desire to have them collected into one volume. It may be noted that the papers "Agassiz at Penekese," "The Fate of Iciodorum," "The Story of a Strange Land" and "How the Trout came to California" have taken the place of certain others in the first edition.—F. C. K.

Recent Papers Relating to Vertebrate Paleontology.[3]—The first paper below cited is a review by Dr. Baur, of Chicago, of a

[2] David Star Jordan, 2d Ed. A. C. McClurg & Co., Chicago, $1.50.

[3] Bemerkungen über die Phylogenie der Schildkröten, von G. Baur, Anatom. Anzeiger, XII, 24-25, 1896, p. 561. Jena.

On the Morphology of the Skull of the Pelycosauria and the Origin of the Mammals, by G. Baur and E. C. Case; Anatomischer Anzeiger, XIII, n. 4 & 5, 1897, p. 109. Jena.

paper by Van Bemmelen on the Phylogeny of Tortoises read before the Zoological Congress of Leyden. In this review Baur shows that Van Bemmelen has fallen into a good many errors of interpretation based on embryologic grounds, and presents a sketch of what is no doubt the correct phylogeny of the order Testudinata. The two papers constitute an excellent commentary on the necessity of interpreting embryologic data by the facts of paleontology. An appendix discusses briefly the characters of the Otocœlid family of the Cotylosauria, which the reviewer has regarded as the Permian ancestor of the tortoises (Proc. Amer. Philos. Soc., 1896, p. 122). Baur does not consider this proposition to be proven. He observes that the element which I have called clavicle includes both clavicle and cleithrum, but produces no evidence to support such a view. Were Otocœlus a Stegocephal, his idea might be probable, although the cleithrum is not distinctly visible in the Stegocephal Eryops; but as the former genus is a Cotylosaurian, i. e., a reptile, it is highly improbable, as no reptile is known to possess this element. He also remarks that the possession of a carapace means "gar nichts" in this connection. When, however, we read (p. 557) that "the characteristic of the tortoises is the carapace" it is evident that the words "gar nichts" are much too emphatic. Indeed the possession of a carapace is the essential of an ancestor of the Testudinata, since the Triassic forms possess one already well developed, as Baur has the merit of showing.

In the second paper Dr. Baur in connection with Mr. E. C. Case, describes the best preserved skull of Dimetrodon yet obtained. The authors add some important points to the osteology of the Pelycosaurian skull, but curiously enough do not refer to the anticipation of many of their results in the description and figure of the nearly allied genus Naosaurus published by the reviewer in the year 1892 (Trans. Amer. Philos. Soc., p. 14, pl. II, figs. 7, 7a). They add to what is there stated the description of the bones of the preorbital region, and determine the entire distinctness of the supramastoid ("squamosal")

Ueber den Wirbelbau b. d. Reptilien u. e. a. Wirbelthieren, von A. Götte; Zeitschrift f. Wissensch. Zoologie, LXII, 3, 1896. Leipzic.

Psittacotherium, a Member of a New and Primitive Suborder of Edentata, by Dr. J. L. Wortman. From the Bulletin of the Amer. Mus. Nat. History New York, Nov., 1896, p. 259. The Ganodonta and their relation to the Edentata, by J. L. Wortman, M. D., loc. cit. pp. 59–1896.

The Stylinodontia, a Suborder of Eocene Edentates, by O. C. Marsh, Amer. Journ. Sci. Arts, 1897, Feb., p. 137. New Haven.

Contributions from the Zoological Laboratory of the University of Pennsylvania, No. VII.

element. They announce the presence of a supramastoid arch whose elements were shown to exist in Naosaurus in the paper above cited. They, however, show what I did not discover, that it is separated by a foramen from the postorbitosquamosal arch. This foramen is either not present in Naosaurus, or it has been closed by pressure in the specimen I described. They describe the palatal structure better than has been done hitherto, which turns out to be quite similar to that which I had shown to exist in the contemporary Cotylosaurian genus Pariotichus. It is important to notice here that the supramastoid is identified with the bone called by Baur in the Lacertilia the squamosal. This identification may well be questioned, since it is purely a roof bone in these paleozoic reptiles, while I have shown that Baur's squamosal enters into profound articulation with the cranial walls in the Mesozoic Pythonomorpha. And it is the latter that must explain the nature of Baur's "squamosal" in the Lacertilia, and not the more remote Paleozoic types. (See my discussion of this subject, AMERICAN NATURALIST, 1895, 855, 1003). But whatever the relations between these elements, neither is the squamosal of the Mammalia, which I can now show is the element which I have sometimes called supratemporal and which Baur calls prosquamosal.

As a phylogenetic inference they assert that the Pelycosauria cannot be arranged with the Anomodontia as a suborder of an order of Theromora, because in the Anomodontia there is only one postorbital bar. This, according to my definitions, is true, but supposing, that the Pelycosauria cannot be arranged with the Anomodontia on this ground, the statement that the Theromora "do not exist," is not justified. In 1869[4] the reviewer revised this order, and included in it the Placodontia, Proganosauria, Parasuchia, Anomodontia, Pelycosauria and Cotylosauria. In 1891[5] it was further revised by the inclusion of the Proterosauridæ. In 1894,[6] following the statements of Lydekker, that the Proganosauria (founded on Stereosternum and Mesosaurus only) is probably a Sauropterygian type, this group was omitted, and the Procolophonina of Seeley was inserted, the Cotylosauria and Pseudosuchia having been already eliminated. The name Proterosauria (Seeley) was retained to represent the suborder for which I had used the name Proganosauria, minus the Mesosauridæ (type of Proganosauria). The order thus constituted included the Placodontia, Proterosauria, Anomodontia, Theriodonta and Pelycosauria. I now add that it is probable that the groups discovered by Seeley in S. Africa called

[4] AMERICAN NATURALIST, October.

[5] Syllabus of Lectures on Vert. Paleontology, July, p. 37.

[6] Proceeds. Amer. Philos. Society, p. 110.

by him Gomphodontia and Cynodontia (which are, perhaps, not distinct from each other as suborders) belong to the Theromora. They coincide, in all important points, differing chiefly in dentition, a character in which the Theromora present as many types as the Marsupialia.

In view of these facts it became the duty of the authors of the present paper to retain the order Theromora, so long as others had preceded them in reconstructing it with the advance of discovery. Also in discussing the phylogeny the authors should do their predecessors the justice to quote their latest opinions, and not their earliest, which they had modified or abandoned. In the paper above cited,[7] and others, I advanced the hypothesis that the Mammalia were derived not from the suborder Pelycosauria, as I had at one time supposed (as cited by Baur and Case), but from the more comprehensive order Theromora, a conclusion to which they do not refer. In one paper[8] I remark, "The Pelycosauria *could not*, however, have given origin to the Prototheria, since in that class of mammals there is a well developed coracoid," etc.

The phylogenetic inferences of the authors may be learned from the following quotations. After citing my opinion of 1884 that "the mammalia are descendents of the Pelycosauria," they remark (p. 118) "It is quite evident that the Pelycosauria with the two temporal arches and the specialized neural spines cannot be the ancestors of the Mammalia; they represent a specialized side branch of a line leading from the Proganosauria to the Rhynchocephalia, which becomes extinct in the Permian." It must be remarked here that the specialized neural spines are not a character of the Pelycosauria, as some of the genera do not possess them; and I never introduced them into the diagnosis. The case is similar to that of the basilisks which have enormously elongate neural spines, yet the genus is one of the family Iguanidæ. It is, however, probable as Baur and Case remark, that the Pelycosauria should be excluded from the Theromora and be placed in close relation with the Rhynchocephalia, to which order I have already referred provisionally one of the genera (Diopeus). That the authors agree with me that the Mammalia are descended from the Theromora is evident from their conclusion that the former may have been derived from the suborders Gomphodontia and Cynodontia, which are Theromora. They say, "These forms look very much like mammals and could possibly be ancestral to them." It is thus evident that Baur's term Sauromammalia, which he never defined, is a synonym of Theromora. In

[7] Transac. Amer. Philos. Soc., 1892, p. 25. Origin of the Fittest, 1887, p. 335–6, 346.

[8] Primary Factors Organ. Evolution, 1896, p. 88.

describing the conditions necessary to define the ancestors of the Mammalia, the authors remark: "The mammals have a single temporal (zygomatic) arch; the posterior nares are placed far behind, and are roofed over by the maxillary and palatine plates; the quadrate is completely coössified with the squamosal and quadratojugal; the occipital condyle is double, and the entepicondylar foramen is present in all the generalized forms. The ancestors of mammals must show the same conditions." It is to be inferred from the context that the authors mean that the Reptilian ancestors of the mammals must show these conditions. Important exception must be taken to these statements. The palate is extensively fissured in some Marsupialia, while it is closed in the Placodont suborder of the Theromora. The complete coössification of the quadrate is not to be looked for in a Reptilian ancestor, but its reduction must. Such I have shown to be the case in the Pelycosauria, in Diopeus and Naosaurus, and Seely has shown it to be still more reduced in the Cynodontia. The other characters are found in one or another of the Theromora. Hence I believe that the opinion that I advanced in 1885, that the Theromora are the ancestors of the Mammalia is the correct one.

Some interesting "asides" are to be found in foot-notes to this paper. The authors state correctly that I described two temporal arches in *Diopeus leptocephalus* and, therefore, placed it in the order Rhynchocephalia, and stated that the Pelycosauria have only one arch, which is homologous with the zygomatic arch of mammals. They then add "It is interesting to note that the latter result was reached by Cope (1884) on the identical specimen of (Diopeus) *Clepsydrops leptocephalus.*" This statement, ascribing at the very least, gross carelessness to the author quoted, is throughout untrue. The ascription of a single temporal arch to the Pelycosauria was made by me in the original diagnosis of the suborder in 1880 (Proceeds. Amer. Philos. Soc., p. 38) four years previous to the discovery of the (*C.*) *D. leptocephalus* and in the description of the *C. natalis*, six years previously, in the statement "no quadratojugal arch." This means that the arch present, already described by me in *Clepsydrops natalis* in 1878 (Proceeds. Amer. Philos. Soc., p. 509) as a zygomatic arch, was still regarded by me as such.

In another foot-note the authors make the astonishing assertion that what I have called the columella auris in Diopeus is a rib. The skeleton of this specimen possesses ribs of the usual type, however, and neither in this genus nor in any other is there known a rib with a cup-shaped capitulum with a perforation of its peduncle. I have, moreover, figured a similar stapes in place in the allied genus Edaphosaurus (Transac. Amer. Philos. Soc., 1892, Pl. II, fig. 5a.) with perforation

below the disc. No free head was observed in the latter genus, but it may be concealed.

Dr. Alex. Götte, the distinguished Professor of Leipzic, gives a detailed account of his researches on the embryology of the caudal vertebrae of certain existing Lacertilia, with the view of demonstrating that my doctrine that the intercentra of the caudal vertebræ of the Reptilia are not the homologues of the intercentra of the dorsal series of other vertebrates, and that the conclusion that the vertebral bodies of the Anamnia are chiefly composed of intercentra, while those of the Amniota are centra, is incorrect. He commences by misunderstanding the (p. 376) ground of the doctrine he seeks to overthrow, a very common cause of unnecessary polemic. He says: "The alleged homology of all described intercentra depends exclusively on the assumption that the continuity of the chevron bones with the perichordal bone above them, indicates their genetic identity, so that the latter are an expansion of the bases of the former, or reversed, the chevron bones are processes of the perichordal bones. On the contrary, I can, on the basis of my observations on the development of the saurian vertebra, assert as a fact, that a genetic identity of the intercentra with their inferior arches does not exist, and that these parts originate rather as distinctly separate, as the superior arches and their vertebral bodies." No contradiction of these facts can be justly derived from my papers on the subject, and if I have used the word "continuity" in describing the relations of the chevron bones with the caudal intercentra, it has been in the sense of homological continuity, as in the case of the superior arches and the pleurocentra. That this is true is apparently proved by the facts of paleontology. The ground which is fundamental in this connection is the fact, that the elements which in the genus Cricotus do support the chevron bones and do not, or only in part support the neural arches, and which may be identified by their contracted superior long diameter, are continued all the way through the sacral, dorsal and cervical regions from the caudal, so that the homology may be directly traced. And secondly, because in some species of Cricotus the upper part of the intercentrum in the dorsal region is so pinched as to reduce the body to the form, as it has the position of a large reptilian intercentrum.

Dr. Götte denies the homology of the caudal and dorsal intercentra and of different intercentra with each other on the following grounds. First, the centra of vertebrata are not homologous bodies; second, the chevron bones in Batrachia are primitively distinct from the caudal

intercentra, and do not necessarily pertain to them; third, that in certain Lacertilia (e. g., Anguis) the chevron bones are coössified with the centra, as is the case in the Batrachia Urodela; fourth, that the neural arches of the caudal vertebræ of Lacerta are partially divided on on each side by a fissure or foramen, which he regards as evidence that the vertebræ of reptiles consist of two original elements, that is, are produced by the fusion of the two bodies of the embolomerous type of column. His general conclusions are stated at the end of the paper as follows:

"(1). The construction of complete vertebræ with bodies and arches in the series of the Amiidæ, as in that of the Stegocephali and all living digitates begins in an embolomerous form, i. e., with double vertebræ to each segment. (2). The change of these double vertebræ into simple ones is accomplished by the fusion of the pairs after both vertebræ more or less, or especially the posterior one, have retrograded. (3). The rhachitomous vertebra is neither a primitive nor an independent appearance, but only a transitional stage in this change. (4). The principal significance of the embolomerous origin of the vertebra for the digitate vertebrates lies in the inheritance of certain remains of the double structure, the arches, transverse processes and ribs whose permanent forms are only to be understood on this ground."

As regards the question of the non-homology of the vertebral bodies, I believe that I have shown that they are for the most part not homologous as between the Anamnia and the Amniota, but that the homology of the contents of each of these divisions is shown by paleontologic evidence. It is also clear that many if not all of the vertebral bodies in the two great divisions in question must be homologous, otherwise we must have as many original ancestors of the vertebrata as there may be kinds of vertebral centra, a proposition which no one will be found to believe. In fact the embryology of forms of life of comparatively recent origin such as the Lacertilia, is apparently, from Göttes researches, as it should be supposed a priori, incompetent to explain the phylogeny of structures which received their definite completion in the paleozoic ages of time. *Owing to cenogeny, is is quite certain that structures may be directly related phylogenetically, which may appear to be in their present ontogeny not homologous.* This consideration applies to the supposed non-relation of the chevron bones to intercentra. This relation is universally demonstrated by paleontology, and better evidence than the changes of position in late forms such as occurs in Anguis (to which I have added Anniella) and the snakes, must be cited to invalidate it.

As regards the precedence of the rhachitomous over the embolomerous type of vertebral column, paleontologic evidence demonstrates that this was the history as regards Teleostomous fishes and Digitata (or Amniota), as Zittel has shown to have been the case in the former and I have shown as to the latter. Embolomerous forms do not come first in geologic time in these divisions, but later. I have not made any attempt to interpret with respect to this hypothesis, the structure of the vertebral column in the Selachii. They afford, however, no support to Prof. Götte's hypothesis, since it is probable that the Selachian vertebral column originated in a rhachitomous condition. In notochordal sharks, e. g., the Ichthyotomi, the primitive vertebræ are represented by centra above and intercentra below, as in the Teleostomi and Stegocephali. The superior segment supports the neural arch, and the inferior the hæmal arch. Götte's first proposition, that the embolomerous condition is the primitive one, is shown to be untrue as to the true fishes by the facts adduced by Zittel and others, since the primitive vertebræ of fishes described by these authors is rhachitomous and not embolomerous. Prof. Götte does not observe that his fig. 6 (text, p. 384) of Callopterus, represent rhachitomous caudal vertebræ, and dorsal vertebræ in which the centrum (pleurocentrum) is greatly reduced, so that the intercentrum becomes by far the larger part of the vertebral body. This is in exact accord with what is found in the Stegocephali, and is contributive evidence that the vertebral body in the Anamnia is intercentrum. That the body in the Amniota is centrum is abundantly proven by the characters of the Permian Pelycosauria.

In this study we have again an excellent illustration of the relative value of embryologic and paleontologic research in determining the homologies of parts and phylogenies of types. As to this Prof. Goette expresses himself thus (p. 377): "Since these relations can only be directly observed or completely known in living animals, and not in the fossil Stegocephali, so it is a self evident proposition that the unknown can only be explained by the known, the extinct by the living animals." This proposition must now, in view of the results of modern research be reversed so as to read as follows: *Since these relations can only be completely known or directly observed in fossil animals, and not in the embryonic history of living forms, it is a self evident proposition that the unknown can only be explained by the known, the living by the extinct animals.* Conceding the great value of embryology in the premises, it has now become fully evident that it can only be understood when interpreted by paleontology. An excellent illustration is the case of the embryology of the vertebræ of Amia, described by Hay and

Gadow, the former of which is discussed by Götte. The two researches only agree in discovering a much greater complexity in the ontogeny of these vertebræ than paleontology gives the least ground for supposing to have ever existed in the adult types of extinct Teleostomous fishes.

In his papers on primitive Edentata Dr. J. L. Wortman describes more fully than heretofore on new material, characters of the genus Psittacotherium Cope. He finds that it is armed with robust compressed claws, and that the foot is short and megatheroid in appearance. He interprets the dentition in a new way, and then homologizes with it the dentition of the genera Hemiganus and Ectoganus. The teeth formerly described as incisors in these genera he regards as canines. To these he adds Stylinodon Marsh, to form a family Stylinodontidæ. The genera Onychodectes and Conoryctes Cope he places in a family Conoryctidæ. Both he combines into a suborder Ganodonta of the order Edentata.

Whether the interpretation of the dentition of Psittacotherium and Ectoganus is correct or not depends on the interpretation of the same parts in Calamodon. Some doubt must still remain as to this point, a doubt which I have always felt. It is certainly not unlikely that Dr. Wortman's interpretation may turn out to be correct, and if true, a clearing up of the subject of the relation of these forms to the Tillodonta of Marsh will result. Accepting his view as correct, we have then a group having strong claims to being regarded as ancestral to the Edentata. This position I maintained as long ago as 1875, when (in the Report of the U. S. Geol. Geogr. Surv. W. of 100th mer., Vol. IV) I included some of these forms (Ectoganus and Calamodon) in a suborder Tæniodonta, and suggesting its ancestral relation to the Edentata. I have not pressed this view recently for the reason above referred to. The name was, however, given, and it was applied to a group so far equivalent to Wortman's name Ganodonta, that as matter of taxonomic rule it cannot well be displaced. His reasons for rejecting the name are that I referred two of the genera (Conoryctes and Onychodectes) to the Creodonta, which I still do; that I failed to recognize the affinities between Calamodon and Stylinodon, which, however, I always have done so far as the imperfect description of Marsh would permit. Thus, in my Synopsis of Families of Vertebrata, AMERICAN NATURALIST, October, 1889, I place in the suborder Tæniodonta, the two families Ectoganidae and Stylinodontidae. Wortman concludes also that the name must be rejected because founded in error. If this be true, it is

no reason for the rejection; on the same ground nearly every name in Biology above the specific would have to be rejected.

Although Dr. Wortman makes excellent use of the material at his disposal, and throws much light on the characters of some of the genera, the evidence for the reference of the Tæniodonta to the order Edentata, must be considered as yet very obscure. But the reference to that order of Conoryctes and Onychodectes is still more difficult, if not impossible. If proper, a new definition of the Edentata must be forthcoming. I am still of the opinion that the best provisional place for these two genera is in the Creodonta, next the Tæniodonta, to which they have probable affinities. The position of Dr. Wortman is based on the scientifically untenable assumption that because forms probably stand in the relation of ancestor and descendent they must therefore belong to the same genus, family, order, etc. He goes so far as to place Esthonyx in the Tillodonta, to which it is probably ancestral, although it does not possess the essential character of that order or suborder—incisors growing from persistent pulps. For equally valid reasons all the genera of a phyletic line might be regarded as a single genus. This kind of formulation casts to the winds all taxonomy, and the effect of it is seen in this instance in Dr. Wortman's failure to define the order Edentata. It was the consideration of such forms as Conoryctes and Onychodectes with Esthonyx and the Tæniodonta and certain Insectivora, that led me to propose the comprehensive order of Bunotheria, which is the source of all the Unguiculate orders of later time.

Professor Marsh's article is a much needed description of his genus Stylinodon, of which he has obtained some important parts of the skeleton. It looks more like an Edentate than any of the other Tæniodonta, with which I placed it in 1889. The figures which he gives, will prove valuable to paleontologists, but more light will be necessary before its relation to the Edentata can be determined. Prof. Marsh cannot let the opportunity pass without proposing a new subordinal name, "Stylinodontia," which he does not characterize, although there are already two other names in the field before him, one of which, Tæniodonta, was proposed and defined twenty-one years ago. The rambling discussion as to the origin of the Edentata which closes this paper adds nothing to our knowledge of the subject, especially as it includes the names of genera which he has never defined, and which are so far unknown to science.—E. D. Cope.

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General Notes.

PETROGRAPHY.[1]

Italian Petrography.—The third part of Washington's[2] paper on Italian petrography deals with the Bracciano, Cerveteri and Tolfa districts. The products of the Bracciano volcano may be separated into a leucitic and a non-leucitic group. The non-leucitic rocks contain orthoclase and basic plagioclase, in this respect resembling the vulsinites and the ciminites, but they are more acid than these types, containing sometimes as much as 72 per cent. of SiO_2 a part of which separates as quartz. They resemble the quartz-trachytes of Tuscany, and thus occupy the position in Brögger's classification reserved for the quartz-trachyte-andesites. The author calls the members of the group toscanites. The leucite rocks of this volcanic center embrace leucitites, leucite-tephrite and leucite-phonolite.

The rocks of the Cerveteri district are toscanites and leucitites, and of the Tolfa district, toscanites.

An analysis of the toscanite of Castle Hill, Tolfa, follows:

SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	Na_2O	K_2O	H_2O		Total
65.19	16.04	1.16	2.48	.99	2.92	2.26	6.11	1.85	=	99.00

The Quartz-Porphyry in the Ruhr Valley, Westphalia.—This rock has been described several times by geologists, but it has been reserved for Mügge[3] to investigate it microscopically. It occurs in massive and in schistose phases and in the form of a breccia associated with schists. The massive variety resembles, in many respects, a gneiss. It is banded in light and dark irregular bands. Spherulites united by what was once a glassy matrix marked by perlitic cracks constitute the groundmass in which phenocrysts of quartz and orthoclase are imbedded. The rock has suffered profound mechanical and chemical alterations. The quartz grains are crossed by fine lamellae extinguishing in different positions, and by others extinguishing nearly together. The latter are visible in ordinary light. They are phenomena of translation.[4] The groundmass is filled with tiny veins of quartz, stringers of a sericite-chlorite aggregate and nests of quartz and newly

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Jour. of Geology, Vol. V, p. 34.

[3] Neues Jahrb. f. Min., etc., B. B. X, p. 757.

[4] Cf. Neues Jahrb. f. Minn., etc., 1892, II, p. 95, 98, 1895, p. 213.

formed feldspar. The schistose porphyries differ from the more massive ones in the greater degree of their alteration. Analyses of the two types follow:

	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	K_2O	Na_2O	H_2O	Total
Massive	76.50	15.68	.78				1.10	4.92	.88	= 99.76
Schistose	72.08	16.15	2.21		.18	.68	5.23	.21	2.40	= 99.14

The porphyry breccias consist of fragments of porphyry and of schists in a foliated matrix composed largely of porphyry and schist débris. In origin they are believed to be reibung's-breccias formed at the juncture of schist and porphyry. The paper is handsomely illustrated with photo-lithographs of thin sections.

The Eclogite of the Fichtelgebirge.—Newland[5] gives a few notes on the eclogites comprising a portion of the central gneissic cone of the Bavarian Fichtelgebirge. Mineralogically, the eclogite is so varied in composition that the rock is very difficult to define. Its most characteristic component is garnet, but, in addition to this, it contains also omphacite, hornblende, cyanite, zoisite, sphene, andesine, muscovite, zircon, pyrites, magnetite, rutile, quartz, and a few other minerals. No olivine could be found in any of the sections, although it was searched for. The pyroxene, hornblende and feldspar are often arranged in intergrowths resembling granophyre, and the pyroxene or garnet is surrounded by a radial aggregate of feldspar, hornblende and omphacite, which, under low powers, looks like a reaction rim. Analyses of the rock indicate that it is nearly allied to certain types of eruptives. (I) represents the composition of the eclogite from Markt Schorgast, and (II) that of a diabase from Fichtelberg;

	SiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	CaO	MgO	K_2O	Na_2O	H_2O	CO_2		Total
I.	48.81	16.25	6.00	7.48	.43	9.72	7.12	.46	2.64	.12		=	99.03
II.	47.60	15.29	7.09	6.87	.12	8.41	6.48	1.40	3.62	2.14	.16	=	99.18

Nodular Granite from Finland.—Frosterus[6] describes a new nodular granite from Kangasnierni Parish in Finland. The rock was found as boulders in morainal deposits. It is a biotite-granite in which the nodules are thickly strewn. Each nodule is composed of three quite distinct parts—an inner nucleus of biotite, sometimes with a fragmental outline, surrounded by a zone of coarse granite and an outer zone of fine-grained granite. Outside of these are several distinct envelopes, the inner of which consists principally of feldspar and the outer of biotite and feldspar. In the envelopes the feldspar is radially

[5] Trans. N. Y. Ac. Sciences, Oct., 1896, p. 24.
[6] Bull. Com. Geol. d. la Finlande, No. 4, p. 1.

arranged. The author describes in detail the features of the different portions of the nodules and illustrates them with some handsome figures. The central parts of the nodules are believed to be inclusions of gneiss that have been affected by magmatic alterations. Surrounding these is a zone composed of a coarse aggregate of andesine, quartz, microline and other components of a normal granite, next a zone of a fine grained and radial aggregate of biotite, plagioclase, orthoclase and quartz, and finally the concentric shells. The zones surrounding the nucleus are thought to be due to contact action between the granite and the included gneiss. The inner concentric shell is composed of plagioclase, quartz, orthoclase and biotite on the inner side and principally microcline on the outer side. The outer shell is fine grained, and is composed of biotite, orthoclase, plagioclase and quartz. The rock surrounding the nodules possesses no special features different from those of normal granitites. Its material grades into that of the nodules.

Analyses show clearly an increase in acidity from center to periphery of the nodules, which are, on the whole, more acid than the mother-rock. After discussing the origin of similar structural phenomena in other rocks, the author concludes that the nodules in the Finland granite are due to crystallization around the centers of crystallization afforded by the inclusions of gneiss.

Volcanic Ash from the North Shore of Lake Superior.—N. H. Winchell and U. S. Grant[7] report the existence of volcanic ashes in the Keweenawan series near Duluth. The rocks in question resemble fine grained impure sandstone. They are associated with diabases, basalts and rhyolites. In thin section they are found to be composed of fragments, apparently of vesicular lavas, in a matrix consisting of a secondary aggregate of quartz, feldspar, chlorite, epidote, calcite and iron oxides. A few of the fragments show traces of perlitic parting.

The Diabases of Goslar.—The diabases in the middle Devonian schists of Goslar in the Harz are discussed by Rinne.[8] The rocks are always in the form of sheets interleaved with the schists. Most of these are intrusive, but, in a few instances, volcanic bombs and other evidences of the presence of surface volcanic products indicate the existence of active volcanoes in the district, though diabase tuffs have not been found. From the general appearance of the upper surface of some of the sheets there can be no doubt but that they were lavas.

[7] Amer. Geol., Vol. XVIII, p. 211.

[8] Neues Jahrb. f. Min., etc., B. B. X, p. 363.

The bombs are found strewn through the schists associated with the diabase. Their macroscopic features are carefully described with the aid of a number of figures. Some of the sheets are porphyritic with phenocrysts of irregularly outlined oligoclase surrounded by micas in a groundmass with the composition of normal diabase. The augite in this groundmass is sometimes idiomorphic, and in nearly all cases it is bordered by a rim of hornblende; often the hornblende replaces feldspar laths embedded in the pyroxene, forming of them complete pseudomorphs. The augite is replaced by calcite in some specimens, and by chlorite in others.

The four structural types recognized by the author are: compact gabbroitic phases, compact ophitic varieties, compact porphyritic kinds and amygdaloidal varieties. The gabbroitic diabases are all gabbro-like in the land specimen. In thin section the feldspar grains break up into an aggregate of feldspar laths. The ophitic diabases present no unusual features except that in the coarse grained varieties the large feldspar grains are filled with inclusions of the other components. The amygdaloids are sometimes porphyritic, more frequently normal. On the contact between the diabase and the schists, both rocks have suffered from the effects of contact action. The diabase is much denser near the contact than at a greater distance from it, and in places is much altered, quartz being an abundant product of this alteration The schists, which are mainly roofing slates, are crystallized near their contact with the eruptives.

MINERALOGY.[1]

The Production of Precious Stones in 1895.—Under this title Kunz[2] reviews the chief features of the gem industry for the year, giving specially copious details concerning the American production.

A six-carat diamond was found at Saukville, Wis., six miles from Milwaukee. In California several diamonds were found, one at Alpine Creek, Tulare Co., five near Oroville, Butte Co., and about as many more from near the "head of the creek," probably referring to one of the sources of the Feather River. From the association with peridotite, it seems probable that more may be found in this region.

In South Africa the De Beers Company produced diamonds to the value of about $15,000,000 in the year ending July 1, 1895, and the

[1] Edited by Prof. A. C. Gill, Cornell University, Ithaca, N. Y.

[2] Seventeenth Annual Report of the U. S. Geol. Survey, 1896, pp. 895–926.

output of the same company for 1896 has been sold for $26,000,000. The total of the dividends paid by the South African diamond companies in the past ten years has been $58,000,000. A 640 carat diamond called the Rietz, found in 1895 is superior in quality to the Excelsior (971 carats) discovered a year or two earlier. The extent of the South African deposits is much greater than hitherto supposed, and many new workings are being opened. Near Winburg, in the Orange Free State, diamond diggings of a prehistoric race were discovered.

Stonier states that the diamonds of New South Wales occur in a Tertiary (?) deposit, and may have been derived from an intrusive mass of peridotite, now serpentinized. They are said to be of better quality than those from South Africa.

The great advance in the price of carbonado, which has trebled in value, has stimulated the search for substitutes. The only source of carbonado is Bahia, Brazil, where a single lump weighing 3,073 carats was found during the year. The practicability of using artificial diamonds seems improbable in the light of Moissan's experiments, who has made several hundred crystals with a total weight of about ½ carat on an outlay of $2000. This is about 2000 times the value of natural diamond powder.

Mr. Kunz has named the hydrocarbon to which the phosphorescence of certain diamonds is attributed, *Tiffanyite.*[3]

Rubies have been found in place near Franklin, Macon Co., N. C., in decomposed gneiss with garnets and chlorite.

Brown and Judd[4] have recently described the occurrence and methods of obtaining the rubies of the noted Burmese mines, where the paragenesis is much like that of the corundum at Orange Co., N. Y., and Sussex Co., N. J. In Siam rubies and sapphires have been obtained during the past few years from the Patat Hills. From Black Creek, New Zealand, rubies are also reported. Sapphires and a few rubies are gotten by sluicing the detritus of a decomposed limestone in Fergus Co., Montana. The outlook in this locality is promising. The Montana rubies and sapphires are extremely varied in color.

A number of rich green tourmalines were found in 1895 at Mt. Mica, Paris, Me. Five of these were cut into gems of from five to fifty-seven carats in weight. At Haddam Neck, Conn., five hundred dollars worth of tourmalines of various colors were obtained.

Turquoise is reported from Cripple Creek and from Castle Rock Spring, Col. A mixture of prosopite and quartz closely resembling turquoise was found at Provo, Utah.

[3] Trans. N. Y. Acad. Sci., May 20, 1895, p. 260.

[4] Phil. Trans., Vol. 187, A, pp. 151–228.

Unusually fine opals from near Salmon City, Idaho, as well as other occurrences of opal in Idaho, Washington, Oregon, Arizona, California, Colorado and Georgia are mentioned. Australian opals were sold for more than $100,000 in 1896.

In addition to the above named gems, mention is made at greater or less length of andalusite, cyanite, garnet, quartz, amethyst, chrysoprase, plasma, moss agate, labradorite, lapis lazuli, rhodochrosite, realgar, amber, xenotime and monazite.

The total value of the gem production in the United States for 1895 is placed at $113,621, of which $50,000 is accredited to turquoise.

The Coloring Matter of Minerals.—The cause of the varied colors of certain minerals is discussed by Weinschenk,[5] who presents a large number of facts tending to show that these colors are much less frequently due to organic substances than has been hitherto assumed. From considerations of the paragenesis of minerals, it is suggested that compounds of the elements tin, zirconium, titanium, cerium, didimium, lanthanum, nickel, tantalum and beryllium are in many cases more likely to be the true source of the minerals' colors. The effect of the cathode rays and X-rays in producing a similar color in minerals, even in some cases where the color had been previously destroyed by heating, is cited as evidence against the organic nature of the coloring matter (?). The occurrence of colored minerals as a result of the cooling of a fused magma is evidence in the same direction. The suggestion is thrown out that the color of certain minerals may be a valuable index to the conditions of their origin, when investigation shall have determined the true cause of the color.

Pearceite and Polybasite.—The systematic working out of the relationships existing between various isomorphous minerals has received another important contribution from Penfield.[6] Hitherto the name polybasite has been applied to a group of minerals whose chemical composition is of the type seen in the formula $Ag_9\,SbS_6$, in which Ag is partly replaced by Cu, Fe or Zn, while the isomorphous arsenic molecules may occur in any proportion, almost to total replacement of antimony by arsenic in some specimens. The new name *Pearceite* is proposed in honor of Dr. Richard Pearce of Denver, Col., for the sulpharsenite, while the old name polybasite is restricted in its application to the sulphantimonite.

[5] Zeitschr. d. D. geol. Ges., XLVIII, pp. 704–712, 1896.
[6] Am. Jour. Sci., CLII, pp. 17–29, July, 1896.

Pearceite is monoclinic; $\grave{a}:\bar{b}:c' = 1.7309:1:1.6199$; $\beta = 89° 51'$. The crystals have usually a hexagonal aspect. They are black in color with metallic lustre, hardness 3, and specific gravity about 6.15. It is suggested that the high percentage of copper—more than 18%—may account for the opacity of pearceite. It is very easily fusible and gives readily test reactions for its component elements. The pearceite specially studied occurs with quartz, calcite and chalcopyrite at the Drumlummon mine, Lewis and Clarke Co., Montana.

A careful study of the crystal form of polybasite leads to the conclusion that it also is monoclinic instead of orthorhombic or rhombohedral as previously supposed. The axial ratio $\grave{a}:\bar{b}:c' = 1.7309:1:1.5796$; $\beta = 90°$.

Perhaps the most interesting part of the paper is the comparison of pearceite and polybasite with each other and with certain other more or less allied minerals. From this it appears that arsenic compounds have a slightly longer vertical axis than the corresponding antimony minerals. Five cases are cited to illustrate this. Attentiou is also called to the fact that the prismatic angle is nearly 60° as a rule, and that in this respect chalcocite, Cu_2S, and stromeyerite, Cu AgS, closely resemble the sulpho-salts.

Miscellaneous Notes.—Davison[7] gives the name *Wardite* to a mineral which appears from a partial analysis to consist largely of a hydrous basic phosphate of aluminum. It occurs with the Utah variscite, and may be allied to turquoise and peganite.——More careful study of the percussion figure of the micas by Walker[8] discloses the fact that the angle between the rays varies in some instances very considerably from 60°. Muscovite showed an angle of 52° 53′ to 55° 57′, lepidolite 59° 7′ to 60° 12′, biotite about 60°, and phlogopite 60° 52′ to 63° 28′.——On five crystal fragments of the mineral leonite, $MgK_2(SO_4)_2+4H_2O$, Tenne[9] determined its crystal form to be monoclinic, with the axial ratio $\grave{a}:\bar{b}:c' = 1.03815:1:1.23349$, and $\beta = 84° 50'$. This is a considerable variation from the crystal form of blödite, which has the analogous composition $Mg\,Na_2\,(SO_4)_2+4H_2O$. The latter mineral is also monoclinic, but its axial ratio is $\grave{a}:\bar{b}:c' = 1.3494:1:.6715$, and $\beta = 79° 16'$.

[7] Am. Jour. Sci., CLII, pp. 154, 155, 1896.
[8] Am. Jour. Sci., CLII, pp. 5–7, 1896.
[9] Zeitschr. d. D. geol. Ges., XLVIII, pp. 632–637, 1896.

GEOLOGY AND PALEONTOLOGY.

Alleged Fossil Micrococci.—M. B. Renault communicates to the Academy of Sciences (Paris) a note concerning certain Micrococci and Bacilli which he has found in Coal-Measures of Saint-Etienne and of Commentry. They occur in these formations in considerably larger quantities than they do in plants preserved in flint or in carbonate of lime. They are, moreover, less varied in form and dimensions than are those found in silicified plants, and they are not so much carbonized as the plants in which they are found. (Revue Scient., Dec., 1896.) Any positive determination of such objects as are figured and described by M. Renault must, however, be regarded with suspicion, and some new light must be obtained on the process of fossilization before fossil Micrococci can be made credible.

Geology of Luang Prabang.[1]—The observations made by MM. Counillou and Massie during their stay at Luang Prabang, as members of the Pavie Mission, show the following facts:

(1) The existence in the vicinity of the region studied of Productus and Schwagerina limestones, which are the equivalent of the Moulmein (Birmaine) beds, or one of the terms of the Salt Range series, and, perhaps, of the limestones of Sumatra.

(2) The presence, to the northwest of Luang Prabang, of a system of red clays, limestones and graywackes belonging to the Permian period, and exceedingly like the upper part of the Raingung group (India).

(3) The existence of a formation of purple clays and sandstones, beginning with a pudding-stone, and containing remains of Dicynodonts. Up to the present time these reptiles have been discovered only in the Karoo beds of South Africa, the Panchet of India and the Elgin of Scotland. It is natural then to consider this formation as constituting in Laos the base of the Trias.

(4) As to the limestone of Luang Prabang, although these two geologists believe its position to be inferior to the red clays, they cannot determine its exact age for want of sufficient stratigraphic and paleontologic data. (Revue Scientif., Jan., 1897.)

The Position of the Chico-Tejon Beds.—Since the discovery of the Chico-Tejon series of marine beds on the Pacific coast by Conrad,

[1] Luang Prabang is situated on the left bank of the Mekong, in Coachinchina, 99° 45′ long. E. and 19° 54′ 20″ lat. N.

in 1855, there has been much debate over the determination of the age of the series. They were thought at one time to constitute transition beds between the Cretaceous and Eocene. After a critical study of the faunal relations of the series in question, Prof. T. W. Stanton arrives at the following conclusions:

"1. In all known sections that contain both Chico and Tejon the strata are apparently conformable. So far as it goes, this is an indication of continuous sedimentation; but without further evidence it cannot be accepted as proof that there is no break, nor should it be given greater weight than the clear unconformability between Tejon and older Cretaceous beds in Oregon.

"2. The Martinez group of the California Survey is not a simple formation that can be considered a mere subdivision of the Chico, but consists of two distinct portions, one of which is Cretaceous and inseparable from the Chico, while the other is Eocene, and is here classed as Lower Tejon.

"3. The 'intermediate beds,' supposed by Gabb to form a transition from the Chico to the Tejon, are the same as the upper part of the Martinez group and the Lower Tejon. Their fauna, so far as known, includes no distinctively Mesozoic elements.

"4. The Chico fauna is characteristically Cretaceous, its so-called 'Tertiary types' being persistent or modern types that have changed but little from the Cretaceous to the present day.

"5. An examination of the species supposed to occur in both the Chico and the Tejon reduces their number to not more than six, and with one exception those are all persistent types that cannot be classed as Mesozoic. The exception is *Ammonites jugalis*, which Gabb collected from two localities supposed to be Tejon in the Mount Diablo region, but it has not been rediscovered in any subsequent Tejon collections. The Ammonoid seen by Heilprin in the Gabb collection from Fort Tejon may or may not be this species. It is held that the Tejon fauna is essentially Eocene and very distinct from the Chico, even though this ammonite should prove to belong to it.

"6. The time interval indicated by the decided change in faunas from the Chico to the Tejon cannot now be estimated. In fact, there is little evidence that the latter fauna is derived from the earlier, excepting in a few species; and it is possible that all the changes took place by extinction and migration of species during the period in which the barren beds between the latest Chico and the earliest Tejon fossiliferous horizons were laid down. It will not be surprising, however, if evidence is sometime found of a period of erosion at the close of the Cretaceous

on the Pacific coast." (Seventeenth Ann. Rept. U. S. Geol. Surv., 1895–96, Pt. I, 1896.)

The Position of the Periptychidæ.—This family is one of the three which I placed in the Condylarthra on the establishment of that order, the two others being the Phenacodontidæ and the Mensco-theriidæ. With regard to its phylogenetic position, I adopted the view that it is probably the type from which were derived the order Amblypoda. In a synopsis of the latter order, published in 1884,[2] I remark (p. 1129), "It was not until later (1877) that I assumed that the Diplarthra are descendants of the Amblypoda, although not of either of the known orders, but of a theoretical division with bunodont teeth. That such a group has existed is rendered extremely probable, in view of the existence of the bunodont Proboscidia and Condylarthra. This hypothetical suborder has been called Amblypoda Hyodonta." * * "The existence of Amblypoda Hyodonta is rendered almost certain by the discovery that the genus Trigonolestes[3] of the Wasatch epoch is an artiodactyle with tritubercular bunodont superior molars. The ancestral type of such a form must have been a tritubercular bunodont amblypod. Pantolambda is such a form with the tubercles modified into Vs. Moreover, such a type (Amblypoda Hyodonta) would be derived from a a Periptychid Taxeopod, with but little modification of the latter. A distinct facet of the astragulus for the cuboid bone, and probably a change of the carpus by an articulation of the unciform and lunar bones would be all that would be necessary. The discovery of Pantolambda has increased the probability of such a change having taken place in the hind foot, since the astragalus is intermediate in form between those of Coryphodon and Periptychus."

I have never concealed from myself the possibility that the Periptychidæ themselves might prove to be the Amblypoda Hyodonta. The astragulus has a considerable articulation with the cuboid bone, which has an obscure angular distinction from the facet for the navicular. So far as this articulation goes the family might be placed in the Amblypoda. I have awaited the discovery of the carpus of the Periptychidæ from that day to this (seventeen years); but success has not attended the efforts of Osborn and Wortman, who have searched for it. It is now, however, time to remark, that as there has been no other type discovered which could represent the Amblypoda Hyodonta, the probability that the Periptychidæ are that type, is increased. It is eminently

[2] AMERICAN NATURALIST, 1884, p. 1110.

[3] "Pantolestes" in the original=*Trigonolestes brachystomus*, which is not a Pantolestes.

probable that, since the alternation in the tarsus in that family is undoubted, it will also be found to exist in the carpus, as required for the missing type. Should this prove to be the case, the Periptychidæ must be removed from the order Condylarthra to the Amblypoda, where it will form the second family of the suborder Taligrada, the other family being the Pantolambdidæ. The two families will differ in this, that in the Periptychidæ the molars are bunodont, while in the Pantolambdidæ they are primitively selenodont, or with V-shaped cusps. This arrangement, if correct, puts the Periptychidæ in direct ancestral relationship to the Diplarthra, and so far confirms Schlosser's hypothesis that that family is the ancestor of the Artiodactyla. This view is also in accordance with that expressed by Osborn and Earle in their important paper on the Fossil Mammals of the Puerco; Bull. Am. Mus. Nat. Hist. New York, 1895, p. 47.

The families of the Condylarthra will be, in that case, the Phenacodontidæ and the Menscotheriidæ, and the Pleuraspidotheriidæ of Lemoine, if the last be different as a family from both of the others. —E. D. Cope.

Glacial Beaches of Michigan.—During the past year Mr. F. B. Taylor has made a study of the moraines, abandoned beaches and outlets of the glacial lakes which formerly occupied the southern part of the lower peninsula of Michigan. His conclusions are as follows:

The glacial waters that gathered in the Erie, Huron and Ontario basins during the retreat of the ice-sheet underwent many changes. In falling from their highest level to the present level of Lake Erie the

Stages.	Lakes.	Beaches.	Outlets.	Moraines.
1	Maumee	Van Wert	Fort Wayne	Defiance.
2	Unnamed	Leipsic	Imlay	Toledo and Detroit.
3	Whittlesay	Belmore	Tyre Ubly	Port Huron, Saginaw.
4	Unnamed	Arkona	Undecided	Undecided.
5	Warren	Forest	Pewamo	Undecided.

(Bull. Geol. Soc. Amer., Vol. 8, 1897).

glacial waters changed the place of their outlet four or five times. At each change they paused for a time, sufficient to make a distinct beach. For the whole series of lakes the author would propose a descriptive,

general name, as the Erie-Huron lakes, and for each separate stage having a separate outlet a particular name. Mr. Taylor's especial contribution to science in this paper is the discovery of certain outlets and the correlation of the shore-lines (as shown by the beaches), the outlets, and the retaining dams (indicated by the moraines) of the separate lakes. The relations of these features to each other are discussed in detail, but may be indicated by the table on page 336.

Lake Agassiz.—Mr. J. B. Tyrrell suggests that Lake Agassiz had its beginning as follows: Starting with the Dawson idea of three great centers of snow and ice on the North American continent during the glacial period, he traces the history of the centre great glacier (Kewatin) which originated northwest of Hudson Bay. A portion of this glacier occupied the basin of Lake Winnipeg and the Red River Valley for a long time. As it retired a portion of the eastern or Laurentide glacier was advancing. The Kewatin glacier seems to have retired northward well into Manitoba, and possibly even beyond the northern limit of that province, before it was joined by the eastern glacier. When they united the water was ponded between the fronts of the two glaciers to the north and east, and the high land to the south and west. Such is the origin of Lake Agassiz. Its waters rapidly rose until they overflowed southward into the valley of the Mississippi, and then gradually declined as the river Warren deepened its channel. (Journ. Geol., Vol. IV, 1896).

The Prehistoric Dog.—M. Th. Studer, of Berne, has presented an interesting work to the *Soc. helvetique des sci. nat.* on the races of dogs found in the lacustrine deposits of the Stone Age. These are *Canis palustris*, a small species dating from the neolithic; a large dog found in Lake Ladoga and Lake Neuchatel, which is related to the Siberian sledge-dog; and *Canis familiaris Leineri*, a large, slender dog, reminding one of the Scottish greyhound.

The shepherd dog appeared in the Age of Bronze, and also a hunting dog (*Canis familiaris matris-optimæ* and *Canis fam. intermedius*). These different races have a common palearctic origin. The Mediterranean and Egyptian races are derived from a different type of equatorial origin. (Revue Scientif., Jan., 1897).

Geological News.—Mesozoic.—The Museum of Lyon publishes in its Archives the drawings made by M. Jourdan, of a series of singular organisms which he classed as Echinoderms under the names *Pegmacrinus cupulatus*, *P. radiatus*, *P. inflatus* and *P. gracilis*. Since Mr. Jourdan's death these organisms have been much in dispute; zoologists

refuse them a place among Echinoderms, and botanists deny their being calcareous algæ. On the same plate are figured two fine Echinoderms from Cirin. They are described by M. P. de Loriol. (Arch. Mus. d'hist. nat., Lyon, T. 16, 1895).

A new fossil fish reported by Mr. R. Storms from the bruxellien sandstone is remarkable for its size. It is referred to the genus Cybium with the specific name *proostii*. Its mandible measures 34 centimeters. If its proportions correspond with the modern *C. regale*, its total length must have been not less than 2.55 m., or double that of *C. bleekerii*, found in the same formation. (Bull. Soc. Belge de Geol., T. IX, [1895] 1897).

Cenozoic.—Nine new species and varteties of Ostracoda from the Pliocene beds near Berkeley, California, are described and figured by Mr. Frederick Chapman. The specimens are such as inhabit fresh water at the present day, with the exception of one, a Cypripopsis, which is as often found in brackish water. They are all comprised in the family of the Cypridæ. It is suggested by Dr. Merriam that the Ostracoda may be of use in determining horizons of the Berkeley Pliocene beds. (Bull. Dept. Geol., Univ. Calif., Vol. 2, 1896).

An interesting bone breccia was discovered some months ago in the neighborhood of the Wombeyan caves, New South Wales, by Mr. R. Broom. The deposit is old, and contains a few new forms, 5 of which are described in the Proceeds. Linn. Soc., N. S. W. According to the author this 1895–96 collection from this deposit gives a fair idea of the smaller animals living in later Tertiary times. One of the important discoveries was that of *Dromicia nana*, represented by a number of both lower and upper jaws. This find establishes Thomas' theory that Dromicia existed formerly in Eastern Australia. Mr. Broom considers it probable *D. nana* still survives in the district of the Wombeyan caves. (Proceeds. Linn. Soc., N. S. W., 1896).

The fossil bones of several species of monkeys found in the caves of Brazil by Lund have been recently described by M. H. Winge. With one exception the species are still existing, and are found in the same localities to-day. The one extinct species, to which M. Winge gives the name *Eriodes protopithecus*, is represented by several detached bones, which cannot be referred to one individual, but which, without doubt, can be referred to the same species. The new form resembles *E. arachnoides*, having the same long, slender limbs, but shorter fingers, and the measurements show that it must have been a very much larger animal than its living relative. (E. Museo Lundii, Kjobenhavn, 1895–96).

BOTANY.[1]

New Species of Fungi from Various Localities.—The following new species of fungi have been received from various localities in North America within the past few months:

Polyporus subluteus E. & E. On decaying beech, London, Canada, November, 1896 (Dearness, 699c). Effused with the upper margin more or less reflexed, margin or surface of the pores light yellow (when dry), substance soft and pliable, pilei about 1 cm. long by 3–4 cm. broad, white, short-tomentose, zoneless, subimbricate, margins obtuse, flesh thin, white, of woolly-floccose texture, not at all fibrous. Pores uneven, subcolliculose, unequal in size, round or subsinuous, $\frac{1}{3}$–$\frac{3}{4}$ mm. diam., $\frac{3}{4}$–1 cm. long, margin subdentate, dissepiments thin. Spores oblong, a little narrower at one end, white 4–6 x $1\frac{1}{2}$–2μ. The pores, like the flesh of the pileus, are white inside.

Poria subviolacea E. & E. Underside of decaying oak limbs, lying on the ground, Newfield, N. J., September and October, 1896.

Subiculum archnoid-tomentose, white, loose, not separable from the matrix, hymenium at first violet-color with the pores mere hemispherical depressions, but the violet soon fades to dirty white, or yellowish-white, and the pores become more elongated, but still short, more or less irregular in shape, with the margins dentate. Spores allantoid, hyaline, $3\frac{1}{2}$ x 1μ. Soft, juicy and flexible when fresh.

Favolus striatulus E. & E. On rotten limbs in woods, Mt. Cuba, Delaware, July, 1896 (Commons, No. 2781).

Stipitate. Pileus convex-plane, firm and rigid when dry, umbilicate, radiate-striate with fine, more deeply colored lines, but not sulcate, 4–5 cm. across, pale light yellow when dry, margin paler, sublobate and uneven, narrowly incurved. Stem central, about 1 cm. long and 3–5 mm. thick, enlarged above into the pileus, solid, pale yellowish, under the lens finely velutinous. Pores unequal, decurrent, subquadrangular or elliptical, 1–2 mm. deep, margins acute and minutely erose-dentate. Spores allantoid, hyaline, 5–7 x 1μ. Color, pale yellow throughout.

A coarser, thicker plant than *F. curtisii* Berk., and lacks the ciliate margin and setulose stipe, nor can it be referable to *Polyporus alveolarius* Bosc.

Corticium ferax E. & E. On dead wood, Canada (Macoun). Thin, farinaceous, white, immarginate, soon developing in the central parts

[1] Edited by Prof. C. E. Bessey, University of Nebraska, Lincoln, Nebraska.

small patches of yellowish, smooth, waxy hymeium. Spores elliptical, hyàline, abundant, 4 x 3μ.

PENIOPHORA GLOBIFERA E. & E. On bark of *Abies*, Canada (Macoun). Effused, thin, soft when fresh, brittle when dry, cinereous, not cracking, closely adnate, margin at first fringed with appressed, silky, white hairs, which soon disappear. Cystidia at first globose, soon prolonged above into stout, rough, lanceolate processes, 40–70 x 8–10μ, hyaline. Spores small, globose, 3μ diam. The cystidia are very abundant and easily seen with a low power, causing the hymenium to appear pubescent.

ASTERELLA PROSOPIDIS E. & E. On living bark of *Prosopis dulcis* (Mesquite), near Monterey, Mexico, July, 1896. Dr. B. F. G. Egeling.

Perithecia gregarious or scattered, superficial, depressed-conical, ½ mm. diam., with a black, shining subconical ostiolum. Asci clavate-oblong, 30–35 x 8–10μ, subsessile, 8-spored, with stout linear paraphyses. Sporidia biseriate, fusoid, hyaline, uniseptate, not constricted, subacute, 12–14 x 4–4½μ.

CHAETOMIUM SETOSUM E. & E. On damaged hay in stacks, Rooks Co., Kansas, August 1896 (Bartholomew, No. 2214).

Perithecia at first ovate or ovate-conical, or cylindric-conical, becoming obovate and often flattened above, and contracted below so as to appear stipitate, 400–500μ high, clothed with straight, erect-spreading, smooth, black hairs, 150–200μ long and 5–6μ thick below, tapering above, not branched, with mycelium of reticulate, rough hyphæ and a fringe of brown, subundulate, short hairs around the base. Asci subelliptical, 10–12 x 6–7μ. Sporidia elliptical, brown, 4–5 x 3–4μ, and 2–2½μ thick.

Differs from *Ch. melioloides* C. & P. in the simple, smooth hairs that clothe the perithecia.

SORDARIA VIOLACEA E. & E. On horse dung, Rooks Co., Kansas, September 15, 1896 (Bartholomew, No. 2263).

Perithecia semiemergent, 2–4 confluent, 700–800μ diam., slightly depressed-globose, more or less roughened, with thick walls consisting of an outer dark-colored coriaceous sheet lined inside with a thinner, violet-colored membrane. Ostiolum hemispherical-papilliform or subdiscoid-depressed. Asci clavate-oblong, rounded at both ends, sessile. Paraphyses abundant, but indistinct. Sporidia 8 in an ascus, oblong-elliptical, becoming opaque, 30-45 x 19–21μ. The perithecia are mostly in confluent groups, but there is no true stroma.

SORDARIA AMPHISPHÆRIODES E. & E. On cow dung, Rooks Co., Kansas, August, 1896 (Bartholomew, No. 2249).

Perithecia scattered or 2–4 together, mostly about ¾ mm. diam., membranaceous, globose or slightly depressed-globose, entirely buried in the matrix which is not discolored within, the very short neck terminating in a depressed-globose, or subdiscoid ostiolum perforated in the center and erumpent through a black, superficial, stromatic shield, exactly as in *Clypeosphæria.* Generally the ostiolum is seated in a slight depression. Asci cylindrical, 220–230 x 20μ, very short stipitate, with cylindrical, continuous paraphyses longer than the asci and about 4μ thick. Sporidia uniseriate, elliptical or oblong-elliptical, yellowish, becoming opaque, 27–30 x 19–21μ, not appendiculate. Allied to *S. merdaria* (Fr.) and *S. macrospora* Awd., but distinguished from both by the stromatic shield.

PODOSPORA MINOR E. & E. On old stalk of *Zea mays*, Rooks Co., Kansas, July, 1896 (Bartholomew, No. 2204).

Perithecia loosely gregarious, erumpent superficial, ovate-conical, 500 x 400μ, loosely clothed, except the black, obtuse, stout, short-cylindrical ostiolum, with spreading brown hairs. Asci cylindrical, 150 x 20μ. Sporidia obliquely uniseriate, ovate-elliptical or almond-shaped, 25–35 x 15–22μ, with a cylindrical, obtuse, brownish appendage 12–15 x 4μ at base, and sometimes with a much shorter, deciduous one at the apex. Differs from *P. brassicæ* Kl. in its smaller size throughout.

ROSELLINIA BIGELOVIÆ E. & E. On dead stems of *Bigelovia graveolens*, Golden, Colo., December, 1896 (Bethel, No. 15).

Perithecia erumpent-superficial, scattered or gregarious and cespitose, ovate-globose, ¼–⅓ mm. diam., with a distinct, acutely papilliform ostiolum. Asci cylindrical, about 50 x 5μ. Paraphyses filiform, abundant. Sporidia uniseriate, oblong elliptical, brown, 6–8 x 3½–4½μ.

PHYSALOSPORA BETULINA E. & E. On birch bark, Newfoundland, September, 1896 (Rev. A. C. Waghorne, No. 62).

Perithecia subgregarious, sunk in the bark, but the apex raising the epidermis into pustules, ovate-globose, 400–550μ diam., light colored inside. Ostiolum inconspicuous. Asci clavate-cylindrical, 110 x 12μ, with abundant paraphyses. Sporidia uniseriate, elliptical or obovate, hyaline with one or two large nuclei, 18–22 x 10–12μ.

LEPTOSPHÆRIA PHASEOLORUM E. & E. On old bean vines (*Phaseolus vulgaris*, cult., with *Diaporthe phaseolorum* C. & E., Newfield, N. J., July 27, 1896.

Perithecica scattered, ovate-globose, about ¼ mm. diam., covered by the epidermis, which is raised into slight pustules and pierced by the conical or conic-cylindrical ostiolum. Asci clavate-cylindrical, short-stipitate, paraphysate. Sporidia biseriate, oblong-fusoid, subobtuse,

slightly curved or subinequilateral, 3–5 septate and constricted at the septa, hyaline, becoming brown, 16–22 x 5–6μ. Differs from *L. artemisiæ* Fckl. in its smaller size throughout.

PLEOSPORA FINDENS E. & E. On dead culms of *Andropogon virginicum*, Newfield, N. J., October, 1896.

Perithecia buried, globose, 150μ diam., with the conic-tuberculiform ostiolum erumpent. Asci cylindrical, short-stipitate, 130–150 x 12μ. Paraphyses none. Sporidia uniseriate, oblong, 5-septate, most of them with one or two cells divided by a longitudinal septum, straw-yellow. Many of the sporidia are without any longitudinal septa, resembling *Leptosphæria.* The pycnidial form is a *Hendersonia*, similar outwardly to the ascigerous, but with fusoid, straw-yellow, 3–4 septate sporules, 20–34 x 3–5μ.

PLEOSPORA OLIGOSTACHYÆ E. & E. On leaves of *Bouteloua oligostachya*, Rooks Co., Kansas, October 1896 (Bartholomew, No. 2325).

Perithecia scattered, hemispheric-prominent, small (200μ), black, with a minute papilliform ostiolum. Asci oblong-cylindrical, short stipitate, 65–75 x 12–14μ, with abundant paraphyses. Sporidia beseriate, oblong-elliptical, subinequilateral, 3-septate, scarcely constricted, one of the cells often divided by a longitudinal septum, but quite as often this is wanting, 14–17 x 6–7μ.

DIAPORTHE RADICINA E. & E. On bulbous base of culms of dead *Phleum pratense*, Newfield, N. J., December, 1896.

Perithecia in small groups buried in the matrix, which is blackened on the surface, about ¼ mm. diam. Ostiola erumpent, short-cylindrical, smooth, obtuse. Asci (p. sp.) cylindric-fusoid, 40–45 x 5–6μ. Sporidia 1–2 seriate, oblong, 3–4 nucleate, scarcely constricted, 10–12 x 3–4μ.

EUTYPELLA POPULI E. & E. On dead limbs of *Populus*, Canada (Macoun).

Stroma orbicular, convex, 1–2 mm. diam., seated on the wood and raising the bark into pustules, not circumscribed. Perithecia 12–30 in a stroma, closely packed, ovate-globose, about ¼ mm. diameter. Ostiola short cylindric-conical, erumpent in a dense, flat-topped fascicle, distinctly quadrisulcate. Asci (p. sp.) about 20 x 4μ. Sporidia subbiseriate, allantoid, only slightly curved, brownish in the mass, 4–5 x 1–1¼μ.

VALSARIA COLORADENSIS E. & E. On dead bark of *Negundo aceroides*, Overland, Colorado, November, 1896 (E. Bethel, No. 136).

Perithecia 4–6 or more, buried in a cortical stroma consisting of the whitened (but otherwise unchanged) substance of the bark, about ½ mm. diam., with thick coriaceous walls. Ostiola slightly erumpent through small chinks in the bark, subconfluent, conic-tuberculiform,

black, mostly subseriately arranged. Asci clavate-cylindrical, 50–60 x 6–7μ, obscurely paraphysate, 8-spored. Sporidia subbiseriate, oblong-cylindrical, slightly curved, obtuse, brown, uniseptate, but not constricted, 12–15 x 3–3½μ.

The white substance of the stroma is surrounded by a thin, black layer, which, on a horizontal section, shows as a black line. Stroma orbicular or elongated, 2 mm.–1 cm. long.—J. B. ELLIS and B. M. EVERHARDT.

(*To be continued.*)

Botanical News.—The second century of Josephine E. Tilden's American Algæ has been distributed. It continues to maintain the high standard of excellence possessed by the first century. We should prefer to see the editor confine this distribution to the fresh-water algæ, since every marine form is but a duplicate of what one finds in so many other sets.

Professor L. H. Bailey's "Teacher's Leaflets," promise to be of great value, if we may judge from the one issued December 1st, entitled "How a Squash Plant Gets Out of the Seed." It consists of seven pages of text illustrated by fourteen *new* figures of every stage of the process. This leaflet should be in the hands of every High-School teacher of Botany.

We are glad to notice that the handy "Guide to the Organic Drugs of the United States Pharmacopæia," prepared by John S. Wright and published by Eli Lilly & Co., of Indianapolis, has reached its thirteenth thousand, and has been revised and greatly improved.

"Fodder and Forage Plants," by Jared G. Smith; "Useful and Ornamental Grasses," by F. Lamson Scribner, and "Studies on American Grasses," are repectively Bulletins 2, 3 and 4 of the Division of Agrostology in the United States Department of Agriculture. They have both a practical and scientific interest, and reflect credit upon the authors. In Bulletin 4 some generic changes are proposed, and a number of new species are described. The generic name *Chaetochloa* is proposed for *Setaria* (preoccupied), *Chamaeraphis* for *Ixophorus* (distinct genera). Accordingly the familiar *Setaria glauca* is hereafter to be *Chaetochloa* (L.) Scribn., *S. viridis* will be *C. viridis* (L.) Scribn., and *S. italica C. italica* (L.) Scribn.

The second bulletin of the New York Botanical Garden (issued January 1st) contains, in addition to Dr. Britton's vice-presidential address on Botanical Gardens (given before Section F of the American Association for the Advancement of Science), reports, plans, maps, regulations, etc. The map showing the general plan of the Garden is very

interesting, and promises that when fully installed it will be one of the most instructive gardens in the Western Hemisphere.

In a recent number of *Garden and Forest* (January 13), Professor Card makes a strong plea for experimental plant physiology as an adjunct to instruction in modern horticulture. It will repay reading by all botanists, and should encourage the introduction of physiological work in agricultural colleges, where it has generally been neglected, as well as in the larger universities where it has already had some recognition.

Professor Hitchcock's bulletin (62) on Corn Smut, issued by the Kansas Experiment Station, gives, in addition to much relating to structure and the germination of the spores, an extended synonymy and bibliography. He concludes, rather hastily, we think, that the name under which this smut be known is *Ustilago mays zeae* (DC) Magnus (= *Uredo segetum* var. *mays zeae* DC., Fl. Fr., II, 1805, = *Uredo maydis* DC. Fl. Fr., VI, 1815). De Candolle himself did not consider that he had sufficiently designated it in Vol. II of "Flora Francaise," since, in Vol. VI, he does not refer to his note in the earlier volume, but proceeds to describe it as a distinct species under the name *Uredo maydis*. We should not now compel De Candolle to say in 1805 what, ten years later, he himself felt that he had not said.

Another little book has appeared from the facile pen of Professor L. H. Bailey, which is, incidentally, of considerable interest to botanists, although primarily designed for gardeners. Under the title, "The Forcing Book" (The Macmillan Company), he tells much about greenhouse construction, heating and management, which will be most useful to those botanists who possess, or hope to build, a plant-house. The chapters on Lettuce, Cauliflower, Radishes, Tomatoes, Cucumbers, etc., are admirable illustrations of clear presentations, and will be valuable to botanists as well as gardeners.—CHARLES E. BESSEY.

ZOOLOGY.

Paramœba eilhardii.[1]—The amæboid organism to which Dr. Fr. Schaundinn gives this new specific and generic name was found by him in the salt-water aquarium of the Berlin Zoological Institute. Its life history was found to consist of three stages. (1) An amœboid stage, in which the organism measures from 10–90μ microns, is disc-

[1] S. B. K. Preuss. A. K., 1896, pp. 31–41 (12 figs.).

like, and is provided with blunt pseudopodia. In color it is often yellowish-brown, its plasma of a vacuolar honey-combed appearance, and its endoplasm with a large number of granules. Its central nucleus is vesicular and has an alveolar structure. Beside it is a peculiar refractive accessory body unlike anything found in other amœba. This, during the process of division, seems to divide before the nucleus.

(2) An encysted stage, in which the vacuolar appearance disappears, the pseudopodia become retracted, and a cyst-membrane is formed. The sequence of division is (a) the accessory body, (b) the nucleus, (c) the plasma.

(3) A flagellate stage that begins by the emergence from the cyst of oval swarm spores, each possessing two flagella, an ingestive aperture, two chromatophores, a nucleus, and, like the first stage, an accessory body. Leaving out of account this last body the organisms very closely resemble species of *Cryptomonas*. Sometime after emerging from the cyst the spores divide longitudinally, lose their chromatophores, and become amœboid.

Diplodal Sponge-Chambers.[2]—Prof. F. E. Schultz after a re-examination of the matter, using as examples, *Corticium candelabrum* O. Sch., *Chondrilla nucula* O. Sch., and *Oscarella lobularis*, confirms his observations made on the flagellate chambers of the last form in 1877. The chambers have both an entrant and an exit aperture.

The Asymetry of Spirorbis and the Phylogenetic Relationships of the Species of the Genus.[3]—As a result of the examination of a large number of specimens of this genus derived from various parts of the world, and comprising a score of species, it has been found that these serpulids are entirely asymetrical. The form of the spiral is constant for a given species, and is either dextral or sinestral. In the dextral species the operculum is always borne by the second right branchial, while in the sinestral forms it is borne on the left second branchial—thus, in all cases, on the concave side of the animal.

The muscle-fibers are developed to the greatest extent on the concave side.

The intestine and ovaries are crowded to the convex side.

The uncini are most numerous and largest on the concave side.

In the abdominal region there are, speaking generally, n rows of uncini on the right and $n + p$ rows on the left side ($p. = 2–4$).

[2] Zool. Anz., XIX (1896), pp. 426–32.

[3] M. Caulberg and Félix Mesnil. Comptes-Rendus, CXXIV (1897), pp. 48–50.

There are met with in a series of species, dextral as well as sinistral, on the concave side, a third group of uncini, representing a fourth thoracic setigerous ring that is lacking in others.

All this shows the influence of the spiral tube, and is explained by the movements of the animal. The functional activity of the organs of the concave side has preserved them, and is to be taken into account in any phylogenetic grouping.

Taking the direction of the spiral and the presence or absence of the thoracic ring into account, it is evident that the genus *Spirobis* may be divided into four subgenera, as follows:

Dextral species,	
With 3 thoracic rings . .	*Dexiospira.*
With 4 thoracic rings . .	*Paradexiospira.*
Sinistral species,	
With 3 thoracic rings . .	*Læospira.*
With 4 thoracic rings . .	*Paralæospira.*

The Malpighian Tubes of the Orthoptera.[4]—The malpighian tubes of the Orthoptera, as regards their number and length, present a great analogy with those of the Hymenoptera, but differ from them in their disposition and their mode of opening.

Among the divers excretory contents of these glands have been found in abundance: urate of sodium and urate of calcium in *Gryllus;* uric acid in *Gryllotalpa*, in the form of irregular spherical or ovoid concretions or of prismatic crystals; urate of sodium and uric acid in *Blatta* and *Periplaneta*.

Mr. Bordas' studies embraced some forty species of the principal families of Orthoptera, and result in the following conclusions:

In the Forficulidæ the tubes are few (8–10) and grouped into two opposite fascicles.

In the Phasmidæ they are very numerous, and united into 20–24 fascicles (in *Phibalosoma*), opening into an equal number of hemispherical or conical tubercles, which are short and are disposed in a circle around the intestine, of which they are simply evaginations. In *Acanthoderus* and *Necroscia* each collecting tubercle receives only two or three Malpighian tubes.

In the Mantidæ there are some 60–70 urinal tubes, opening sometimes irregularly, sometimes in groups of three to four (*Eremiaphila*). The praying mantis possesses 50–60, united into several bundles, separated by narrow free spaces.

[4] L. Bordas. Comptes-Rendus, CXXIV (1897), pp. 46–8.

In the *Periplanetæ* and *Blattæ* the tubes are grouped into six bundles, each with 15-20 tubes, opening at the summit of a very short conical tubercle. These six tubercles are simple evaginations of the intestinal wall, and are disposed in a circle about the intestine, at almost equal distances from one another. In *Polyzosteria* the tubes are filamentous, short, and likewise grouped into six bundles. In *Blabera* the mode of opening is characteristic, and very different from that in the rest of the Blattidæ. The tubes to the number of 50–60 are plain, embracing about a third of the intestinal circumference.

In the Acrididæ the number of tubes is very variable. Certain species (*Pœcilocerus* and *Pyrgomorpha*) have as many as a hundred, others (*Pamphagus*) have 60–70, others (*Œdopoda*) 70–80, others (*Psophus*, *Pachtylus*, etc.) 50–60. In all the tubes are grouped into a few bundles (5–6).

In the Locustidæ the number of tubes exceeds 100, grouped into six bundles, opening at the summit of 6 cylindro-conical tubercles, disposed sometimes regularly at equal distances from one another, sometimes irregularly, at the origin of the hind gut (*Locusta, Decticus, Salomona, Pseudorhynchus, Platicleis*, etc.). In the Ephippigerinæ one meets with three or four of these tubercles and some 110–120 urinary tubes. Finally, in *Gryllacris*, which in general have but a single, short collecting tubercle, there are some 80–100 Malpighian tubes.

In the Gryllidæ the number of tubes is great, and exceeds a hundred. In *Gryllus* and *Gryllotalpa* one finds 100–120. They open into a long unpaired cylindrical collecting tubule (ureter). This, after a course of 9 mm. to 12 mm., opens at the summit of a conical tubercle furnished with four valves limiting an asteriated orifice (*Gryllotalpa*).

Eels Feeding on the Eggs of Limulus.—In the latter part of May, four or five years ago, while walking at dusk along the Kickemuit River, which flows between the town of Warren and Bristol, R. I., I noticed many horse-feet crawling on the sandy bottom of the river. The tide was high, and they had come in from outside, as is their habit at high water. What attracted my attention the most was the fact that, as they lay there on the river bottom, many eels had worked their way into the clefts between their heads and abdominal regions, and were apparently feeding. Some of the eels were very large, and made a strange sight with their heads under the shell and their tails sticking out sideways. Sometimes two or three were under one horse-foot, and if I had had an eel spear I could have caught a good mess. I have since wondered what the eels were eating. Sometimes I think it might

have been something on which the horse-feet were feeding; but my uncle, who was with me, said that they were after the spawn; and I have since come to the conclusion that he was right, for it was the spawning season, and the eels were only gathered around the large female horse-feet. This spring I intend to make further observations, and find out if this is really the case. Horse-feet are used a little as a food for poultry on some farms in Bristol, and it was in cutting some of them open that I noticed that the large ones were the females, for they were full of eggs.—H. C. Warwell.

Elassoma zonatum East of the Apallachian Mountains.— In looking through the recently issued work by Drs. Jordan and Evermann, on the fishes of North and Middle America, I was reminded of having collected some years ago specimens of one of our smallest and least known fishes, in a locality that considerably extends its range as recorded by these authors. *Elassoma zonatum* is stated in the above mentioned work to occur from southern Illinois to Texas, Louisiana and Alabama. In 1882 the writer obtained specimens in Waccamaw River, near Whitesville, in southeastern North Carolina, and in the Little Pedee River in South Carolina. Evidently it was not at all rare where collected. My specimens were subsequently compared with material from southern Illinois in the collection of the Illinois State Laboratory of Natural History; and as Dr. Jordan had studied this collection in preparing his list of Illinois fishes, there can be no question about correctness of determination.

The number of scales in a longitudinal row along the side is not above 36, oftenest 34 or 35, and this is true also of Illinois specimens. The dorsal fin has 4 spines commonly, sometimes 5, and 10 soft rays, counting the posterior double ray as two. I believe that Dr. Jordan and his followers count this as a single ray, but its structure indicates that it is the equivalent of two ordinary rays. The anal fin has 3 spines and 6 soft rays, counting the double ray again as two. The branchiostegal rays are always 5 in number. In the description of the family Elassomidæ published by Drs. Jordan and Evermann the number of vertebræ is said to be 24 or 25, from which I judge the count was made from the Florida species, *E. evergladei*, which I have not seen, but in every specimen of *E. zonatum* examined by me the number is 29, including the mass which continues as the urostyle, of which 14 are precaudal. Illinois examples were not examined with reference to the vertebræ, but that they agree closely is shown by Dr. Jordan's own statement in the Bulletin of the Illinois State Laboratory (Vol. 1, No. 2,

p. 48, 1878), where the number is given as 28. My material was macerated and then examined with the microscope, and the count verified repeatedly on different specimens.

The colors of the Carolina fishes are the same as those of Illinois examples. The markings which at once catch the eye are a dusky bar below the eye and eleven narrow vertical bars on the side, two of those immediately behind the gill opening being enlarged to form a dusky spot. Three dusky dots at the bases of the caudal rays appear to be a constant character of young fishes.—H. GARMAN, Lexington, Ky.

The Human Tail.—According to Prof. W. Waldeyer,[5] who has recently gone over the subject, a tail is to be defined as a portion of the body that contains the caudal, *i. e.*, post-sacral, vertebræ and sundry other derivatives of caudal segments, all surrounded by integument. With reference to man, Virchow, in 1880, distinguished between tails with vertebræ and soft tails—a distinction generally recognized. As is well known the human embryo always shows evidence of a true vertebrated tail that may even persist after birth, yet in no case is it certain that more vertebral elements are present than are to be found in the normal coccyx. What occurs in tailed human subjects is the soft tail of Virchow, which corresponds to the distal non-vertebrated portion of the tail in other animals. In some cases this may be partly bony, but there is no increase in the number of caudal vertebræ.

ENTOMOLOGY.[1]

The Fauna of the Lower Rio Grande Valley.—Mr. H. F. Wickham publishes[2] an interesting paper on The Coleoptera of the Lower Rio Grande Valley, in which he discusses the faunal relations of the region as follows:

Regarding the true affinities of the Coleopterous fauna and the claim of the region to be considered tropical in its nature, opinions are more or less divided. Mr. Schwarz has stated that "no one can doubt the existence of a semi-tropical insect fauna along the north bank of the lower Rio Grande." Prof. Townsend classes the Brownsville fauna as Lower Sonoran, with a considerable touch of Austroriparian and about twenty-five per cent. tropical. Dr. Merriam has included it in his

[5] S. B. K. Preuss. Akad. Wiss., 1896, 775–84. J. R. M. S., 1896, p. 601.

[1] Edited by Clarence M. Weed, New Hampshire College, Durham, N. H.

[2] Bull. Lab. Nat. Hist., Univ. Iowa, IV, 96–115.

tropical region. Dr. LeConte, writing thirty-seven years ago, speaks of it as a "sub-tropical province."

Looking through the list of species belonging to the five families treated in the present portion of this report, it seems to the writer that no one familiar with the Coleopterous fauna of the United States can pick out more than five or six which can be called characteristic of the Lower Sonoran zone, though it is true that quite a number range into it. A number—perhaps fifteen or sixteen—are tolerably characteristic of the Upper Sonoran, while possibly twelve or fourteen are more particularly tropical. The great majority are species of very wide distribution in eastern and central North America, many of them extending even to the Canadian boundary. No doubt can be entertained, however, that a study of the phytophagous families will yield a larger percentage of Sonoran and tropical species, since we may naturally infer that the carnivorous beetles, of which the present list is mainly composed, are less affected by peculiarities in the flora than the phytophaga.

More will be said on the subject in the concluding number of this article. For the present it will be sufficient to state the conviction that there is even less ground for considering the Brownsville beetle-faunas as Lower Sonoran than for classing it as tropical. The little jungles noted by Mr. Schwarz are to be considered, it seems, almost truly tropical, while, on the other hand, there are large areas of a very different nature surrounding these little forests, with a totally different Coleopterous contingent. Some of these areas are, from their elevated situation and dry climate, almost typically arid Lower Sonoran, while the low-lying damp spots, not tropical, will show a high percentage of forms common in humid regions occupied by what Dr. Merriam has called the Carolinian and Austroriparian faunas. In other words. Brownsville and its environs are not in one life zone, but in at least two, and probably three, the limits of these zones being locally irregular, and determined not by temperature conditions, but by those of soil and humidity, which, through their action on plant life, also influence the insects. The only way in which these conditions could be approximately indicated on a map, would be by spotting it with appropriate colors as in mapping Boreal or Arctic faunæ on isolated mountain peaks.

Life-history of Xylina.—In Bulletin 123 of the Cornell University Experiment Station, Mr. M. V. Slingerland discusses at length the life-history of three species of Xylina—*antennata, laticinerea, grotei* —which have done considerable damage by eating holes in young

apples. "The green fruit worms," he writes, "do most of their damage to the young fruits in May, but some of them continue working until nearly the middle of June. During the first week in June most of the caterpillars get their full growth and then burrow into the soil beneath the trees to a depth of from an inch to three inches. Here they roll and twist their bodies about until a smooth earthen cell is formed. Most of them then spin about themselves a very thin silken cocoon; some spin no cocoon. Within the cocoon or the earthen cell the caterpillar soon undergoes a wonderful transformation which results in what is known as the *pupa* of the insect. Most of these insects spend about three months of their life in the ground during the summer in this pupal stage. Some evidently hibernate as pupæ, and thus pass nine months or more of their life in this stage. Usually, about September 15th, the moths break their pupal shrouds and work their way to the surface of the soil. Most of them emerge in the fall before October 15th, and pass the winter as moths in sheltered nooks; some evidently do not emerge until spring. Warm spells in winter sometimes arouses a few of them from their hibernation.

"During the first warm days of early spring all the moths appear, and doubtless the mothers soon begin laying eggs. No observations have been made on the eggs or young caterpillars in the north, but in a newspaper article published in the south in 1872, it is stated that the eggs are deposited in the spring on the undersides of the leaves. They hatch in a few days, and the young worms begin at once to eat the foliage, or the fruit, or both.

"There is thus but one brood of these green fruit worms in a year. They work mostly in May, pupate in the soil in June, live as pupæ during the summer and sometimes all winter, and most of the moths emerge in the fall and hibernate, laying their eggs in the spring."

Notes on Dragon-flies.—Prof. D. S. Kellicott publishes[3] some interesting data regarding the occurrence of Odonata in Ohio during 1895 and 1896. "In 1895," he writes, "I prepared and published a chart showing what was then known about the distribution and time of flight of each of the eighty-six species of Odonata known to inhabit Ohio. It was believed the record, so far as it went, was reliable. Some species had been found only in limited areas and at definite times in the year. The schedule showed what species occurred in early, mid and late summer, and in northern, central or southern Ohio. But with the opening and progress of the present season, my confidence in

[3] The Agricultural Student, III, 141.

the chart referred to has been severely tested. How did it happen? We naturally turn to the climate and its vicissitudes for the explanation of many things—trivial and grave. Will it help us in the matter in hand?

"The seasons of 1894 and 1895 were very dry throughout the State. Streams and ponds lost all their water and the mud at the bottom was dry and parched for months over large areas. Streams of considerable volume in ordinary years disappeared entirely for weeks or there remained only restricted pools here and there. The winter of 1895–6 was constant for Ohio with less than the average snowfall. The weather remained cold until April 10th, when it suddenly became very warm and remained so with abundant rain. What resulted as to the appearance or non-appearance of dragon-flies? The following notes will state some of the observed facts:—

First—Many species occurred unusually early. The largest number recorded in April at Columbus in any previous year was five; this year it was ten. They were taken in the following order: *Anax junius*, April 13th; *Ischnura verticolis*, April 15th; *Didymops transversa*, *Basiaeschna janata*, *Anomolagrion hastatum*, *Lestes forcipata*, *Tramea carolina*, *Plathemis trimaculata*, *Libellula semifasciata* and *Nehalennia posita*. The variety is not less interesting than the number. Among them are some of our largest species and the smallest; while four families are represented. Five have been taken in April in previous years, although not in the same year. Anax, Ischnura, Didymops, Basiaeschna and Tramea have been taken as early in former years, the first two much earlier, but the remaining forms not until May was well advanced or until midsummer. From this a general statement may be made that five of the ten earliest species appeared no earlier than usual, but appeared suddenly, i. e., after a very few warm days, while five appeared from two to four weeks early than ever before noticed. I may extend this record of early occurrence by saying that thirty-five species were taken before the end of May, and that several of them were those not before seen on the wing until midsummer.

"In this connection let me say that species common to Ohio and the Atlantic coast appear to emerge fully two weeks earlier in the interior than on the coast at the same latitude. Nor is it a matter of isotherms alone, as a glance at an isothermal map and the recorded captures at Philadelphia and New York will show. It is, I suspect, due rather to distribution of heat and affects only early appearing species.

"Second—It is an interesting question, one often asked, but not answered, whether the existing species are fewer than when the country

was more primitive. The diminution of streams, ponds and morasses, as well as the pollution of streams, have been taken to be sufficient causes for their reduction. The unusual conditions for 1894 and '95 naturally lead us to inquire if any light has been shed on the question. What, then, have been the observed results? So far as my observations have gone, and I have been much in the field, there is no evidence in the line expected. Odonata in the region included in these notes have been unusually abundant during the summer of 1896. No species hitherto taken in any abundance has been missed, while several not before taken at all have been abundant. This was unlooked for. Possibly my records indicate this, that the usual abundance in early spring and summer was in the vicinity of perennial waters, and that about the transient ones they were fewer than the normal number; it is certain that all of the six or seven additional species taken were found in the vicinity of such streams and ponds.

"The consideration of the foregoing facts and the conditions which seem to have influenced them leads to a possible clue to the causes. Life of all kinds, plant and animal, in the restricted and concentrated waters of the dry seasons, were excessively abundant. The predacious odonate larvae, so long as any moisture remained, would be in clover; but when the water entirely disappeared, what?

"Unfortunately, there are no records at hand in regard to ability to remain in the mud or within capsules of earth at the bottom of dried-up ponds. Other animals and some large larvae are known to do so. Why not also the larvae of Odonata? If this fact was proven it would easily explain the unusual abundance of dragon-flies this present season in place of an anticipated dearth. Again, the eggs of some species, certain species of Diplax for example, do not hatch immediately, and therefore, may remain in the dust or mud until the autumn rains or until spring. In this connection I may state that *Diplax rubicundula* and *D. obtrusa* have been seen industriously ovipositing among the grass and weeds overgrowing dry ponds and ditches. Eggs thus scattered would certainly have to remain without immersion among dust and rubbish, in some instances, for weeks. The female of *Lestes rectangularis* has been seen ovipositing in stems of Scirpus and Sparganium where no water remained in the marsh and surely did not return for a month. It would appear from these incomplete observations that the nymphs of Odonata may and probably do readily pass the trying times of drouth unharmed.

"Third—Records made this summer have confirmed conclusions of former years that southern forms extend their range on the western

border of Ohio to Lake Erie. I may cite, as example, *Dromogomphus spoliatus*, which, until taken by me at Toledo, was recorded only from the extreme south. I do not remember to have seen it in any private or public collections. This year, along the Maumee River, it was exceedingly abundant."

Changes of Intestinal Epithelium in Tenebrio.—Herr C. Rengel has studied the changes of the intestinal epithelium in the metamorphosis of the Mealworm (*Tenebrio molitor*) and compared them with those occurring elsewhere. Regenerative cells, from which the new epithelium is derived, appear as subepithelial islands in very young larvæ, but it is only when the metamorphosis begins that they give rise to the elements which form the invaginal epithelium. As in Muscidæ the disruptions begin with an energetic contraction of the muscular layer, and the old mid-gut epithelium is raised off. Its disintegrating cells are held together in a "cyst" by their membranea propria, and form the "yellow body." The muscles undergo gradual disruption without active invasion by phagocytes as occurs in Muscidæ. Korotneff compared the two modes to chronic and acute pathological processes. As soon as the larval muscular layer had been disrupted, nuclei are seen surrounding the epithelial cylinder. Whether these nuclei are old or new elements is doubtful, but the small cells of which they form the centers become the fibrils. Rengel's opinion is that many muscle-cells survive the general revolution, just as a large number of epithelial regeneration cells persist. The latter give origin to the epithelial cylinder, the former to the muscular layer. (Journ. Royal Micros. Soc.)

PSYCHOLOGY.[1]

Dreams.—At the Psychological Congress last year, Dr. J. Mourly Vold, of Christiania, reported some experiments which he had undertaken with regard to the artificial stimulation of visual elements in dreams. The subjects included a large number of persons of different ages, sexes and classes, but were mostly adults of an intellectual type above the average; all those selected were good dreamers. Dr. Vold arranged the experiments as follows: To each of his subjects he sent, from time to time, a package containing figures of animals, well-known objects, etc., cut out of white paper, or some striking colored object—

[1] Edited by H. C. Warren, Princeton University, Princeton, N. J.

a flower, coin, etc. The package was only opened after the subject was in bed. The contents were then displayed on a black backgronnd, and scrutinized closely for a considerable time—usually from two to ten minutes—without intermission; in some cases for half an hour or more, interspersed with periods of rest. The light was then put out, and the eyes closed. In the morning, immediately on awaking, the subject wrote a report of his dreams, together with the conditions of fatigue the night before, length of sleep, etc. Prof. Vold supplemented these reports, when it seemed desirable, by verbal questionings. Some 300 separate tests of this nature were made.

On examining the results, it was found that the character of the dreams depended on a number of distinct factors, such as the quietness and uneventfulness of the preceding evening, but that it did not depend (so far as could be discovered) on the specific time of experimentation or of awakening, nor on the obtaining of after-images from the given objects. The size, form and color of the objects were rarely all reproduced together, but one or two of these conditions often reappeared in the dreams. The form and size of the object were frequently reproduced, either as in the original or with some modification; this transformation often occurred in the dream itself. The color exerted an influence independent of the other factors, and this proved the point of greatest interest in the results. When the given objects were black or white (with complimentary background) the dreams in many instances exhibited recurring contrasts of light and shade. Often the object reappeared (with considerable change of form) in the same color as shown; or some other object appeared in the given color, which might be a very unusual one for it to take; in this case, either the color of the background reappeared also, or no background was discerned. In experiments with colors other than black and white, the given color also tended to reappear; this was especially the case with red; the color might recur in the same tone, saturation and brightness as in the given object, or it might appear modified in these respects; or, such a modification might take place in the course of the dream, as in the case of modifications of form.

The author concludes from these experiments that the visual apparatus immediately before awakening reproduces to a certain extent the condition present at the time of falling asleep; but that the original associations of form, size, color and abstract representation are broken up, and new syntheses constructed in their stead. In these new syntheses the common visual forms, or abstract representations of daily life, are apt to become associated with the colors or outlines of objects which

affect the organ of vision just before the beginning of sleep. Some such theory seems necessary to account for the facts brought out in these experiments.

In a note in the *Revue philosophique,* M. E. Goblot speaks of the connection between dreams and the act of awakening. He urges the view that dreams which we remember are those which accompany the latter state. The passage from sleep to wakefulness, like that from wakefulness to sleep, is not an instantaneous process; it occupies at least an appreciable time. The dreams which we are able to remember afterwards are those that belong to this period of transition; and this fact, the author insists, is more than a mere coincidence. When we analyze a remembered dream, we find in its last stages always some elements of external sensation, which gradually (or quickly) unfold into the conditions of normal waking life. All the organs of sense and movement do not wake at the same time; and to this is due the transition period just mentioned. It is only the dreams of this period—in which some of the conscious elements are those of sleep, while others belong to waking life—that we are able to connect through memory with after-consciousness; and the memory connection is due to precisely this association of elements of waking consciousness with the dream elements. This is the reason, says M. Goblot, why we do not remember those dreams occurring early in the night, in which we talk, cry out, gesticulate, or walk, though such dreams can scarcely fail to have been most vivid; for, unless they result in our awakening, there is no associative element in waking consciousness capable of recalling them. Even those dreams which we do recall have usually so slender an associative element that they are speedily forgotten, unless we take special pains to impress them upon the memory by writing them down, or rehearsing them soon after waking.

The present writer would suggest that more attention be paid, in the study of dreams, to determining the normal visualizing power of the individual. It is well known that some persons habitually "visualize" their visual memories (*i. e.*, represent them in the form and color of the original); while others, including those more accustomed to abstract thinking, are lacking in this power, and substitute words or other symbolism for the visual picture. The same is true to some extent of sounds and other classes of sense memories. In sleep, where outer stimulation is practically wanting, central images play the chief rôle, and in the absence from consciousness of more vivid presentations are mistaken by the subject for primary sense impressions. It would seem, then, that there ought to be a broad distinction of some sort between the

dreams of the visualizing and symbolizing types of individuals. Whether good visualizers are better dreamers, or whether their dreams are merely of a different character from those of symbolizers, remains to be seen. But certainly the question is well worth investigating. So far as I know, no attempt has yet been made to gather data bearing on this point. —H. C. W.

Courtship of Grasshoppers.[1]—Prof. E. B. Poulton has observed this process in two different genera of Acridiidæ. In the case of *Pezotettix pedestris* the sombre brown male quietly awaits, without audible stridulation, the appearance of a female, and jumps upon her unawares. At first she tries to escape, but after a little struggle submits. Before pairing the male nibbles the female gently, and while holding her keeps moving his short legs up and down. This latter process Prof. Poulton regards as a vestige of true stridulation, and that it may still be of use in influencing the female in some way.

In the case of *Gomphocerus sibiricus* the process is much more ceremonious, the males stretching out their four palpi, stridulating, and even patting the female. Apparently the habits are influenced by temperature, for certain phases of courtship could be studied most satisfactorily when the insects were first aroused to activity.—F. C. K.

ANTHROPOLOGY.[2]

Recent Pile Structures made by Seminole Indians in East Florida.—Mr Henry G. Bryant, Secretary of the Geographical Society of Philadelphia, informs me that he saw, in the latter part of March, 1896, several pile-built structures made by modern Seminole Indians rising above the water of a salt estuary of the New River in Dade Co., Florida. He, in company with Dr. Murray Jordan, had visited the Seminole settlement called Big City, situated on the eastern side of the Everglades, within reach of the tide-water of New River, and above the site of old Fort Lauderdale, a region now made accessible by railroad from Lake Worth to Miami.

Ascending the river in a small steamboat for some eight or ten miles above Fort Lauderdale, Mr. Bryant, with a local guide, had proceeded in a flat-bottomed boat over a submerged meadow-like country to Big City, which he found to consist of six or eight rectangnlar huts

[1] Trans. Ent. Soc. Lond., 1896. J. R. M. S., p. 516.

[2] This department is edited by H. C. Mercer, University of Pennsylvania.

with the typical palm-thatched roof of the country. Though these habitations were built on higher ground which overlooked a lake-like expanse of water, two or three platform structures were built directly over the water, at a distance of fifteen or twenty feet from the shore. The platforms, about ten feet long by three and a half wide, without roof, rail, mat or cover, and about three feet above the surface of the water, were upheld by four poles driven into the bottom of the estuary. On inquiry Mr. Bryant who observed no objects resting upon them, learned that the platforms served the Indians as beds when, on warm summer nights, an exposed position over the water guaranteed coolness and immunity from mosquitoes.

Just around the end of the peninsula from the Ten Thousand Islands, not, therefore, above ninety miles east of the site of numerous ancient pile-built structures recently unearthed among these Keys by the University of Pennsylvania, the modern pile-set platforms of Big City seemed to furnish an interesting connecting link between the present and the past of Florida. It is hard to see how riparian savages, dwelling in any low-lying, submerged region, could avoid setting structures on piles. The town of Borneo (Lubbocks Prehistoric Times, p. 184), is built on piles like many Dayak villages. So is Sowik in New Guinea. The Turkish fishermen live in pile-set huts on Lake Prasias (near Salonica), just as a pile-built quarter of Tcherkask rests upon the Don, while the natives of Celebes, Solo, Aram, Mindanao, the Caroline Islands and the African gold coast continue the building of dwellings on piles at the present day.

The desire to escape mosquitoes has not been generally quoted as the motive for aboriginal " lacustrine " construction, but I myself have experienced the efficacy of a water surrounding as an immunity against mosquitoes, when house-boating along the mosquito-infested shores and islands of the Lower Rhone. Then I invariably escaped the pests that often swarmed a few yards away by anchoring for the night twenty or thirty feet out from the shore. As at Big City, the desire to escape mosquitoes seems to have inspired the pile builder, so in British Columbia, Lord says, (see Stephens' Flint Chips, p. 123) that Indians on the Suman prairie recently built pile dwellings on a lake in April and June to avoid mosquitoes. Venezuela came by its name (Little Venice) because of numerous aboriginal pile dwellings seen by Alonso de Ojeda in a bay called by him the Gulf of Venice in 1499, while the shores of its interior lake, Maracaibo, present native pile-dwellings inhabited to-day. Considering these facts, it may be suspected that the littoral regions of North and South America will, when thoroughly

examined, more generally reveal this method of Aboriginal construction, not as evidence of a unique type of culture, a "lost race," or a phase of human development, but as a common adaptation of the life of savage peoples, ancient and modern, to their daily environment. To what extent the hybrid Seminoles of Creek origin and post Spanish advent had intermingled with remnants of older tribes (presumably the builders of the Ten Thousand Islands villages) encountered by the first Spanirds in Florida, is unknown, but I heard no mention of pile construction as practiced by modern Seminoles at the meeting of the American Philosophical Society when the recently excavated-pile structures of the neighboring Ten Thousand Islands were discussed.

—H. C. MERCER.

The Grooved Stone Axe in South America.—The idea of the Ethnic unity of American Indians is strengthened by the fact that so common an implement of their stone age as the axe should have been hafted among them in a peculiar fashion (namely, by means of a groove), unknown, it seems, in all other parts of the world except Australia. Continuing to find these grooved stone axes throughout South America adds strength to this interesting contrast between the ancient handicraft of the new and old world, though it appears that the wide distribution of the grooved axe south of Panama has not been often noted. The Columbian Exhibition at Madrid, in 1892, showed a grooved axe (in the Pedro Baranda collection) from Campeche and a number of others from Ecuador, which could not have been distinguished from Delaware Valley specimens. One came from Nicarauga, another from Peru, and several from Bolivia, together with a curious specimen, the base of the groove of which was marked with spiral flutings. Several such axes had been collected among the Tarasco Indians in Mexico, and other typical familiar-looking specimens came from Uruguay with neighbors from the Argentine Republic. Not a few of the axe-like forms from Uruguay, Equador, Nicaragua and the United States of Columbia had round (pounding) or pointed (piercing) rather than blade-like (cutting) ends, and round stones, encircled by grooves of the Sioux hammer pattern, were sometimes noticed, as, for instance, in Equador and Uruguay. That similar mallets (though never axes) hafted on the grooves were common in prehistoric Spain, was shown by a number of ancient Iberian specimens photographed by me at the Museo National, Madrid. Mortillet figures them from Italy, and the Swedish Government exhibited examples at the Columbian Exhibition above-named from the east Sibe-

rian coast of Behring Straits. Notwithstanding a few flat celt-like specimens from Peru, perforated as if for hafting, binding the handles on grooves, seemed to be the universal American characteristic, as against which omnipresent fashion in the new world, we know that the Neolithic peoples in Europe hafted all their stone axes through holes perforating the axe. Why the latter method (granted migration during or after Neolithic times) never reached America remains to be explained.—H. C. MERCER.

MICROSCOPY.

A Method of Preparing Rotifers.[1]—According to N. de Zograf rotifers may be fixed and mounted in glycerin, balsam or dammar and still retain the appearance of life by a slight modification of the method attributed to M. Rousselet in Hennegrey's and Lee's "Traité de microscopie technique."

The animals in a watch glass are narcotized with a solution of cocaine, as used by Rousselet, except that the methylic alcohol is omitted. The solution is added drop by drop to the very small amount of water containing the rotifers. As soon as the movements of the animals cease without having contracted their cilliary apparatus, a considerable quantity of a 1 per cent. solution of osmic acid, diluted with 4–5 volumes of water, is turned upon them and allowed to act for about 2–4 minutes.

Meanwhile a large amount of the liquid is removed with a pipette without disturbing the animals, which have settled to the bottom of the glass. Finally, a weak solution (about 1 volume to 8–10 of distilled water) of crude pyroligneus acid is poured over the animals, and permitted to act for from 5–10 minutes, after which the animals are washed two or three times with distilled water and then the water containing them very gradually replaced by alcohol, commencing with 50 per cent. and finishing with absolute alcohol.

Thus prepared the animals are found to have contracted neither their abdominal appendages, their feet, their band of cillia, nor their tentacles, and can be mounted equally well in glycerin, balsam or dammar. The protoplasm as a result of the action of the osmic acid has a faint gray or brownish tint; and structural details are plainly visible.

The Scirtopods (*Pedalion mirum*) and the Rhizotes (*Melicerta, Lacinularia, Floscularia, Stephanoceros*) give the most beautiful results, and

[1] Nicolas de Zograf. Sur une méthode de préparation des Rotateurs. Comp. Rend. Acad., Paris, CXXIV, 245-6.

sometimes, if the action of the reagents has been only sufficient to fix the animals, they appear in Canada balsam like living animals.

The same method, the author says, has given him perfect results with many infusorians, heliozoans and rhizopods, as well as with *Hydra* and other fresh water forms. With these animals, however, the narcotization is not necessary, but the osmic acid should be increased.—F. C. KENYON.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Boston Society of Natural History.—February 17, 1897.—The following papers were announced: Prof. N. S. Shaler, "Subterranean Water of Southeastern New England;" Dr. C. R. Eastman, "On some Devonian Fish-beds of North America.

March 3.—The following papers were announced: Mr. T. A. Jagger, Jr., "Experimental Study of Mountain Building" (illustrated by models); Mr. J. B. Woodworth, "Geology of the Gay Head Cliff."

March 17.—The following paper was read: Mr. Frank Russell, "An Account of a Naturalist's Voyage down the Mackenzie."—SAMUEL HENSHAW, *Secretary.*

American Philosophical Society.—January 1, 1897.—Mr. Henry C. Mercer read a paper on "The Fossil Sloth of the Big Bone Cave, Tennessee."

February 19.—Prof. E. D. Cope presented a communication on "Some Paleozoic Vertebrates from the Middle States."

March 5.—Prof. Arthur W. Goodspeed exhibited some Recent Radiographs in comparison with the work of a year ago.

University of Pennsylvania.—February 15, 1897.—Program Demonstrations: "Some Types of Insects Injurious to Vegetation," Dr. S. C. Schmucker. Original Communications: "Hatching of Dragonfly Eggs," Dr. Philip P. Calvert; "The Morphology of the Nucleolus," Dr. T. H. Montgomery. Reviews: Drs. Macfarlane and Harshberger.

March 1st.—Program Demonstrations: "The Method of Measuring the Time of Mental Processes," Dr. Lightner Witmer. Original Communications: "Reaction Time of Americans, Indians and Negroes," Mr. Albert L. Lewis. Reviews: "Vertebrate Paleontology," Dr. E. D. Cope; "Physiological Chemistry," Dr. M. E. Pennington; "Botany," Dr. H. C. Porter.—H. C. PORTER, *Secretary.*

The Biological Society of Washington.—January 30, 1897.—The following communications were made: "Brief Informal Notes and Exhibition of Specimens;" C. Hart Merriam "On the Pribilof Island Hair Seal;" C. H. Townsend, "The Origin of the Alaskan Live Mammoth Story;" L. O. Howard, "Parasites of Shade-tree Insects in Washington;" Frank Benton, "The Giant Bee of India."

February 27.—The following communications were announced: "Brief Informal Notes and Exhibition of Specimens;" C. H. Townsend, "The Distribution and Migration of the Northern Fur Seal;" Lester F. Ward, "Description of Seven Species of Cycadoidea from the Iron Ore Deposits of Maryland;" Charles Louis Pollard, "What Constitutes a Type in Botany."

March 13.—The following communications were made: W. T. Vaughan and R. T. Hill, "The Lower Cretaceous Gryphæas of the Texas Region;" Chas. F. Dawson, "The Dissemination of Infectious Diseases by Insects;" William Palmer, "The Type (?) of a New-old Species;" Sylvester D. Judd, "Sexual Dimorphism in Crustacea."—FREDERIC A. LUCAS, *Secretary.*

Anthropological Society of Washington.—February 27, 1897.—The following program was presented: 1. "The Language Used in Talking to Domestic Animals," Dr. H. Carrington Bolton; 2. "Prehistoric Musical Instruments," Mr. Thomas Wilson.—WESTON FLINT, *Secretary.*

The Academy of Science of St. Louis.—January 18, 1897.—Professor H. S. Pritchett presented some results of observations on the recent sun-spots, prefacing his remarks by a general account of our present knowledge of the constitution of the surface of the sun, and of sun-spots in general, and illustrating his remarks by the use of lantern slides.

Two persons were elected to active membership.

February 1, 1897.—Professor L. H. Pammel read a paper embodying Ecological Notes on Some Colorado Plants, observing that botanists who have studied the Rocky Mountain flora have frequently commented on the interest attached to the plants from an ecological standpoint, but most perplexing to the systematist. It is not stange that this should be the case, since there are great differences in altitude and soil, and the relative humidity of the air varies greatly. This is a most prominent factor in the development of plant life. A cursory glance at the plains flora of eastern Colorado shows that there are representatives of a flora common from Texas to British America, and east

to Indiana. We should not for a moment suppose that the species are identical in structure, since the conditions under which they occur are so different. Attention was called to the great abundance of plants disseminated by the wind, as *Cycloloma, Salsola, Solanum rostratum, Populus, Cercocarpus,* "Fire-weeds," (*Epilobium spicatum* and *Arnica cordifolia*), *Hordeum jubatum, Elymus sitanion,* etc. Plant migration may be studied to better advantage in the irrigated districts of the west than elsewhere, partly because the water carries many seeds and fruits in a mechanical way, and partly because the soil is very favorable for the development of plants. Instances were cited where several foreign weeds are becoming abundant, as *Tragapogon porrifolius* and *Lactuca scariola.* The latter, known as an introduced plant for more than a quarter of a century, is common at an altitude of 7,500 feet in Clear Creek Cañon. Once having become acclimated it is easy to see how Prickly Lettuce is widely disseminated.

Collectors appreciate the great importance of giving more attention to conditions under which plants thrive, such as phases of development, soil, climate, and altitudinal distribution. Structures of plants are produced to meet certain conditions. Under extreme conditions, protective devices are more pronounced. In discussing some of the plants, Warming's classification into *Hydrophytes, Xerophytes, Halophytes,* and *Mesophytes,* was adopted. The *Mesophytes* of eastern Iowa were compared with some of the *Xerophytes* of western Iowa, such as *Yucca angustifolia, Mentzelia ornata, Liatris punctata,* etc. These increase in abundance in western Nebraska, and attain a maximum development in northern Colorado. In the foot-hills and mountains the *Metophytes* constitute a large class, although *Xerophytes* are common in dry, open, sunny places. The photosynthetic system is reduced to guard against excessive transpiration, which would otherwise take place at high altitudes. The thick rootstock of Alpine plants in dry, open places is an admirable protection against drouth and cold. In cañons where snow remains on the ground plants do not need this protection. *Halophytes* are not numerous in species and genera. *Hydrophytes* are abundant at higher altitudes, where they occur in marshes and along streams.

February 15, 1897.—Professor J. H. Kinealy presented a preliminary discussion of the Poley air lift pump, a device for pumping water from artesian wells by injecting into the pump tube, at a considerable depth below the surface of the water, bubbles of air from an air compressor.

Mr. Trealease exhibited two hair balls removed from the stomach of a bull in Mexico, and showed that they were composed of the pointed

barbed hairs of some species of prickly pear upon which the animal had unquestionably fed. Attention was called to similar balls from the stomachs of horses, which had been described in 1896 by Mr. Coville, of the United States Department of Agriculture.

March 1, 1897.—Mr. William H. Rush presented a demonstration of the formation of carbon dioxide and alcohol as a result of the intramolecular respiration of seeds and other vegetable structures in an atmosphere containing no free oxygen. The theory of the dissolution and reconstruction of the living nitrogenous molecules was explained in connection with the experiments, and the different behavior of these molecules when supplied with or deprived of free oxygen was indicated.

Mr. H. von Schrenk briefly described certain œdematous enlargements which he had observed at the beginning of the present winter, near the root tips of specimens of *Salix nigra*, growing along the edge of a body of water. The speaker compared these with the œdemata of tomato leaves and apple twigs, which were studied some years since at Cornell University.

Professor J. H. Kinealy exhibited a glass model illustrating the mode of action of the Poley air-lift pump, the efficiency of which he had discussed at the preceding meeting.

One name was proposed for active membership.—WILLIAM TRELEASE, *Recording Secretary.*

Torrey Botanical Club.—January 27, 1897.—The scientific program was as follows: Dr. H. H. Rusby, "Remarks on some Solanaceæ;" Mr. A. A. Tyler, "The Origin and Functions of Stipules;" Dr. J. K. Small, "*Aster gracilis* Nuttall;" Mr. George V. Nash, "New and Noteworthy American Grasses."

Dr. Rusby exhibited a number of solanaceous plants and remarked upon their relationships. It was pointed out that the general appearance and chemical and physiological characteristics of these plants frequently fail to indicate their structural affinities. *Cestrum* and *Sessea*, *Atropa* and *Datura*, were cited as illustrations of the separation of otherwise naturally related groups through their possession respectively of baccate and capsular fruits. *Nicotiana* was referred to as connecting those tribes having a radial symmetry with the tribe Salpiglossidæ, having a bilateral symmetry, and thus connecting the family with the Labiales. The Androcera and Andropeda sections of the genus *Solanum* were instances of the appearance of this bilateral symmetry in a widely separated part of the family, where radial symmetry is the otherwise invariable rule.

Dr. Britton discussed the subject, and remarked upon this instance of development of two divisions of a group along different lines, in this case through baccate and capsular fruits. He cited similar parallelisms in other families, tending to produce different resulting characters—as in *Capparidaceæ;* and remarked that an indication of the lines along which these genera have been derived may be read in these characters.

The second paper by Mr. A. A. Tyler, on "The Nature and Origin of Stipules," presented conclusions derived from studies extending through several years. The subject was treated at length in the light of geological, morphological, anatomical and developmental evidence. Discussing Mr. Tyler's paper, which will shortly be published in full, Dr. Britton remarked that "the outcome of this very important paper is most interesting; it emphasizes the significance of basal scales and those of buds and root stocks; and it is the more convincing, from the nicety with which it accords with the seemingly haphazard distribution of Stipules widely but irregularly here and there through the vegetable kingdom."

Mrs. Britton discussed the paper further, referring to the different phases presented in *Fissidens.*

Of the remaining papers, that by Mr. Nash was read by title, and will appear in the *Bulletin;* and that by Dr. Small was, on account of the lateness of the hour, deferred till the next meeting.—Edward S. Burgess, *Secretary.*

SCIENTIFIC NEWS.

The New Westminster *Daily Columbian* (B. C.) informs us of the death of Mrs. Alice Bodington, wife of Dr. G. F. Bodington, Medical Superintendent of the Provincial Asylum for the Insane. Even the comparatively few who were aware of Mrs. Bodington's illness, from pneumonia, had no idea of there being any immediate danger. In fact, her illness was very brief, scarcely five days, and no dangerous symptoms were developed until Sunday. All that loving care and medical skill could do was unavailing, and, on Monday, February 15th, death released a noble soul from its bodily sufferings.

The deceased lady, who was a native of Suffolk, England, came to the Province, with her husband, about ten years ago, and, after a short residence in Vancouver, they removed to Hatzic, where the doctor engaged in farming, in connection with a country practice. About two

years ago, on receiving his appointment to the asylum, Dr. Bodington removed to New Westminster with his family.

In the comparatively short time since, Mrs. Bodington made many friends in New Westminster, and helped on many a good cause. Besides being an energetic worker in Church of England circles, she was instrumental in forming a local branch of the Botanical Society of Canada, and was a warm friend of the Public Library and of the Art and Scientific Society, before which she read able papers on more than one occasion.

For many years Mrs. Bodington had been well-known in the world of letters. Widely read and a profound thinker, she wielded a strong pen, which was always ready to defend those principles of which she was so able an advocate. Among other works, Mrs. Bodington was the author of "Studies in Evolution and Biology." She was also a regular contributor to THE AMERICAN NATURALIST, *The Popular Science Review* and the *International Journal of Microscopy.* Mrs. Bodington also frequently contributed vigorous articles on various subjects to the Provincial and local press.

Socially, the deceased lady will also be greatly missed, while, as wife and mother, her death is a sad bereavment, and Dr. Bodington and his family have the kindliest sympathy of the community in their irreparable loss. Of the many children of Dr. and Mrs. Bodington, but two, Miss Winnie Bodington and a young son, are at home. Of the others, all grown up, one son is at Plymouth, another also being in England, one is a barrister in Paris, France, another physician on one of the Empress liners, and two daughters, Miss Bodington and Mrs. Hamilton, reside in Winnipeg.

The Goode Memorial Meeting.—On the evening of February 13th, the various scientific, patriotic and historical societies of Washington met in joint session at the U. S. National Museum to commemorate the life and services of the late Dr. George Brown Goode. The meeting was held under the auspices of the joint commission of the scientific societies of the city. After a few introductory remarks by the president of the commission, Hon. Gardiner Hubbard, there followed a brief address from Dr. S. P. Langley, who spoke of Dr. Goode in his relations as a friend and official of the Smithsonian Institution; from Postmaster-General W. L. Wilson, who spoke of him as a citizen and historian; from Professor H. F. Osborne, who spoke of him as a naturalist; and from Professor W. H. Dall, who eulogized him in his relations to the advancement in general of American science. Finally, a set of

eulogistic resolutions were offered by Hon. O. B. Wilcox, President of the society of the Sons of the American Revolution, which were adopted.

Dr. S. L. Schenk has been advanced to the position of ordinary professor of embryology in the University of Vienna. Dr. J. Blaas has had a similar advancement to the chair of geology and paleontology in the University of Innsbruck, and S. Bianchi to the chair of anatomy in the University of Siena.

Dr. K. Möbius has been appointed director of the Museum in Berlin, in the place of Dr. H. E. Beyrich, deceased. Prof. W. Dames has been placed in charge of the geological and paleontological collections.

Dr. Th. D. Pleske has resigned as director of the zoological collections of the Academy of Science of St. Petersburg. Dr. E. Büchner has charge of the collections for the present.

Dr. K. Müller, of Halle, founder and, until recently, editor of the German periodical "Natur," has received the title of Professor from the German Government.

Dr. Carl Claus has resigned the professorship of zoology in the University of Vienna, and Dr. B. Hatschek, of Prague, has been called to the position.

Dr. A. Spuler, known for his studies of the wings of Lepidoptera, has qualified as privat-docent in anatomy in the University of Erlangen.

Mr. B. Waite, formerly of the Department of Agriculture at Washington, has been appointed professor of botany in Georgetown University.

Dr. D. Robertson, who devoted himself in past years to the Fauna of Scotland, died Nov. 20, 1896, at Millport, Scotland, at the age of 90.

Dr. G. Boccardi has been advanced to the position of professor extraordinarius of microscopical anatomy in the University of Naples.

Dr. S. Goto, who studied at Johns Hopkins and Harvard, has been appointed professor of biology in the First High School of Tokyo.

Dr. E. Baumann, professor of physiological chemistry in the University of Freiburg, i. B., died November 3, 1896, aged 49 years.

Dr. F. Czapek, of Vienna, has been called to the position of professor extraordinarius in the Technical High School in Prague.

Dr. L. E. Shore has been appointed tutor, and Dr. A. Eicholtz demonstrator, of physiology in the University of Cambridge.

Dr. R. M. Bolton, of Philadelphia, goes to Columbia, Mo., as instructor in bacteriology in the University of Missouri.

Dr. H. Trimen, director of the Botanical Gardens at Peradeniya, Ceylon, died October 18, 1896, at the age of 53.

Prof. M. Raciborski and Mr. H. Möller, of Lund, are spending the winter at the Buitenzorg Botanical Station.

Dr. J. Szádeczky has been appointed professor extraordinarius of geology in the University of Klausenburg.

Dr. Chas. Julin has been appointed professor of comparative anatomy in the University of Liége.

Dr. F. Noack has been placed in charge of the phytopathological laboratory at Campinas, Brazil.

The African traveler, E. D. Young, died at Hastings, England, Nov. 4, 1896, aged 65 years.

Dr. F. Westhoff, a well-known student of the Diptera, died Nov. 12, at Münster, i. W., aged 36.

Mr. O. F. Cook has been appointed curator of the Cryptogamic Herbarium at Washington.

A. Dorrsett, ornithologist and entomologist, died at Reading, England, November 6, 1896.

Dr. L. Serrurier has resigned the director of the Royal Museum of Ethnology at Leiden.

A. A. Heller has been appointed instructor in botany in the University of Minnesota.

Dr. H. J. Posselt, assistant in the Zoological Museum at Copenhagen, died July 10, 1896.

Dr. A. Pestalozzi has been appointed assistant in the Botanical Museum at Zürich.

Prof. A. Hénon, entomologist, died at Passy, France, Oct. 6, 1896, aged 74 years.

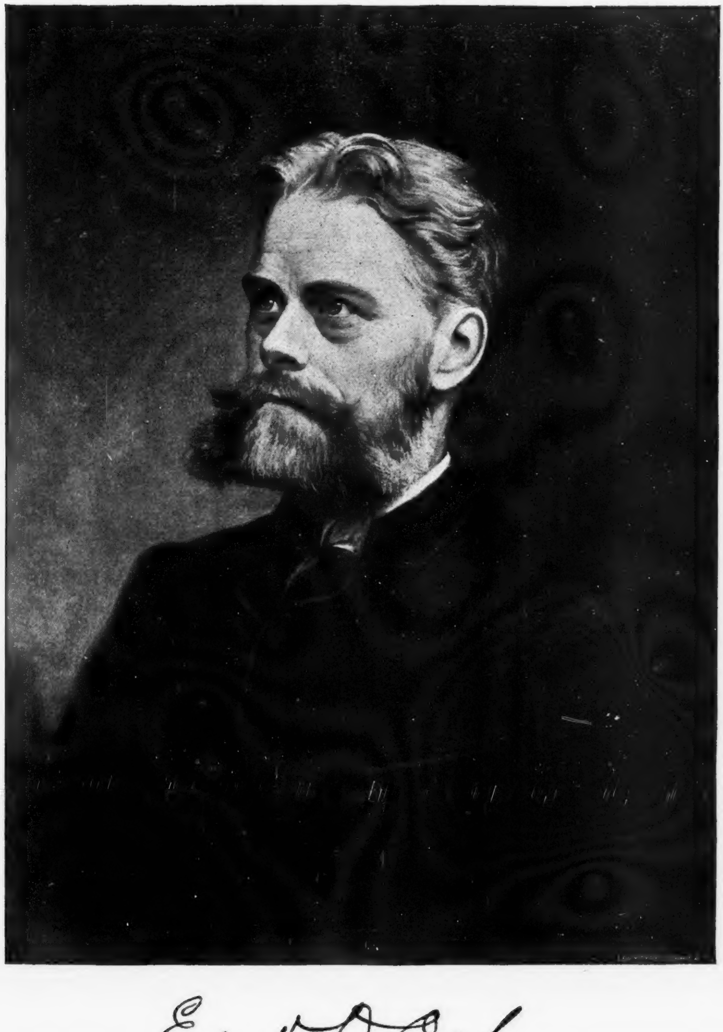
F. Benseler, of the Botanical Garden at Vienna, died Oct. 7, 1896, aged 67 years.

Dr. A. Dürmberger, botanist, died at Linz, Austria, Oct. 26, 1896, aged 59.

Prof. E. Wenzel, anatomist, of Leipzig, died Oct. 25, 1896, aged 56 years.

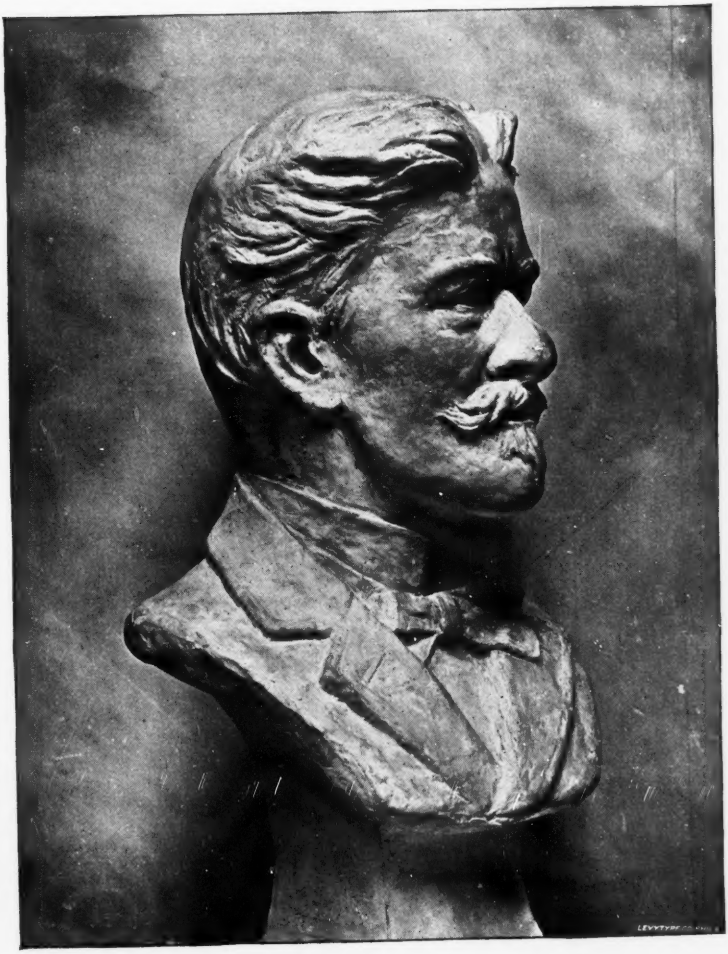
H. D. Van Nostrand, conchologist, of New York, died Oct. 9, 1896.

M. Chaper, conchologist, of Paris, died July 5, 1896.



Edw. D. Cope

From an oil painting by George W. Pettit, of Philadelphia in possession of the American Philosophical Society.



PLASTER BUST OF EDWARD D. COPE.

By Eugène Castello, of Philadelphia.